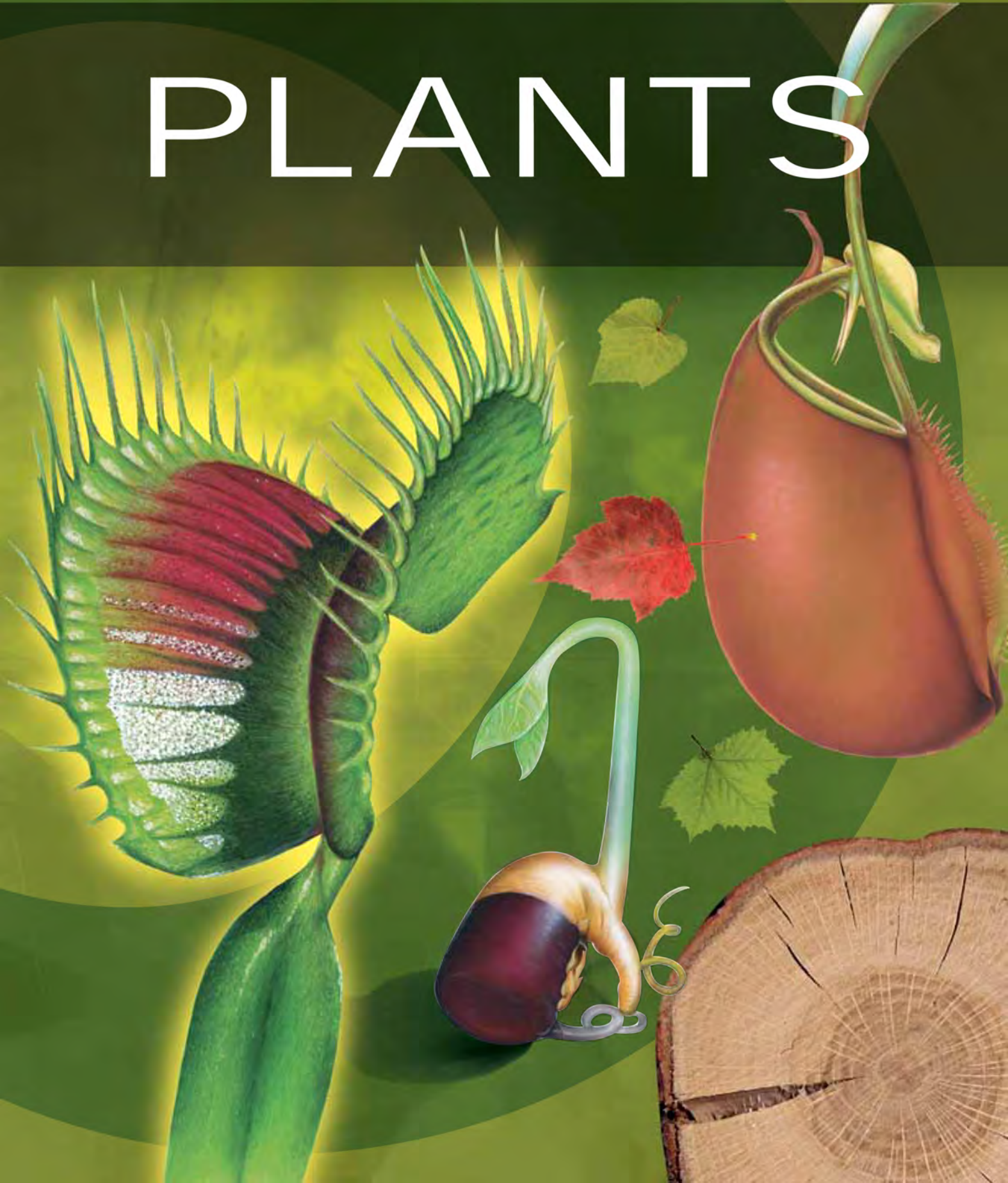
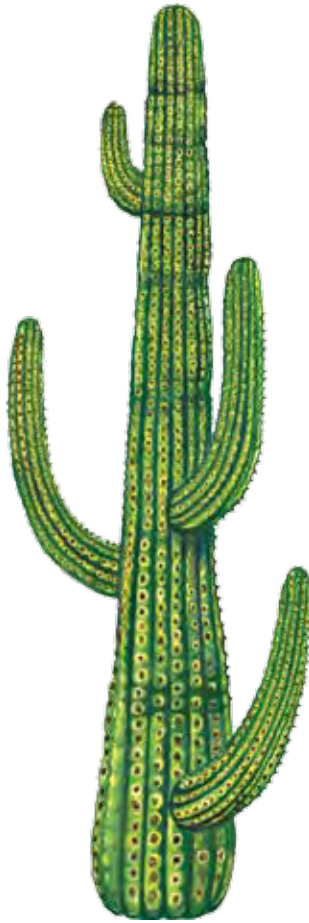


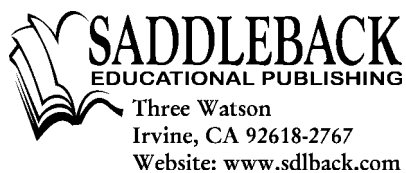
# PLANTS





# Plants





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# Plants



**P**lants are a large group of all living organisms that inhabit Earth. Plants are rooted to the ground, therefore they cannot move around. The first plants to appear on Earth were aquatic plants and algae. When major environmental changes took place on Earth, these plants emerged from water and colonized on land.

## Flower Cluster

Titan Arum which grows in rainforests of Southeast Asia has the largest flower cluster.

## Orchids

Orchids are the largest and the most varied group of flowering plants with flowers of unusual shapes and colors. There are around 25,000 species of orchids.

## fact scope

- Freshwater green algae are the smallest plants.
- The Americas have around 133,000–138,000 species of higher plants.
- Southeast Asia has around 42,000–50,000 higher species of plants.
- Australia has over 500 species of eucalyptus or gum-trees and over 600 species of acacia or wattles.
- New Zealand has over 1500 introduced species of plants.
- Of all islands, the Hawaiian Islands have the greatest number of recorded endangered plants in the world.
- The family Degeneriaceae, native to Fiji, is one of the most primitive vascular plants with an unsealed ovary at the time of flowering.
- The rainforests of Southeast Asia are home to the largest flowers on Earth.



# Plant Kingdom

All plants both living and extinct have been grouped together into the plant kingdom. The plant kingdom is divided into groups based on how they reproduce. The major groups of the plant kingdom are mosses and liverworts, ferns, conifers, and flowering plants. Plants include mosses, ferns, weeds, vines, shrubs, wildflowers, grasses, trees, and others.



## Hierarchy of Classification of China Rose

**Kingdom:** Plantae

**Division:** Magnoliophyta

**Class:** Magnoliopsida

**Order:** Rosales

**Family:** Rosaceae

**Subfamily:** Rosoideae

**Genus:** Rosa L.

## All Plants

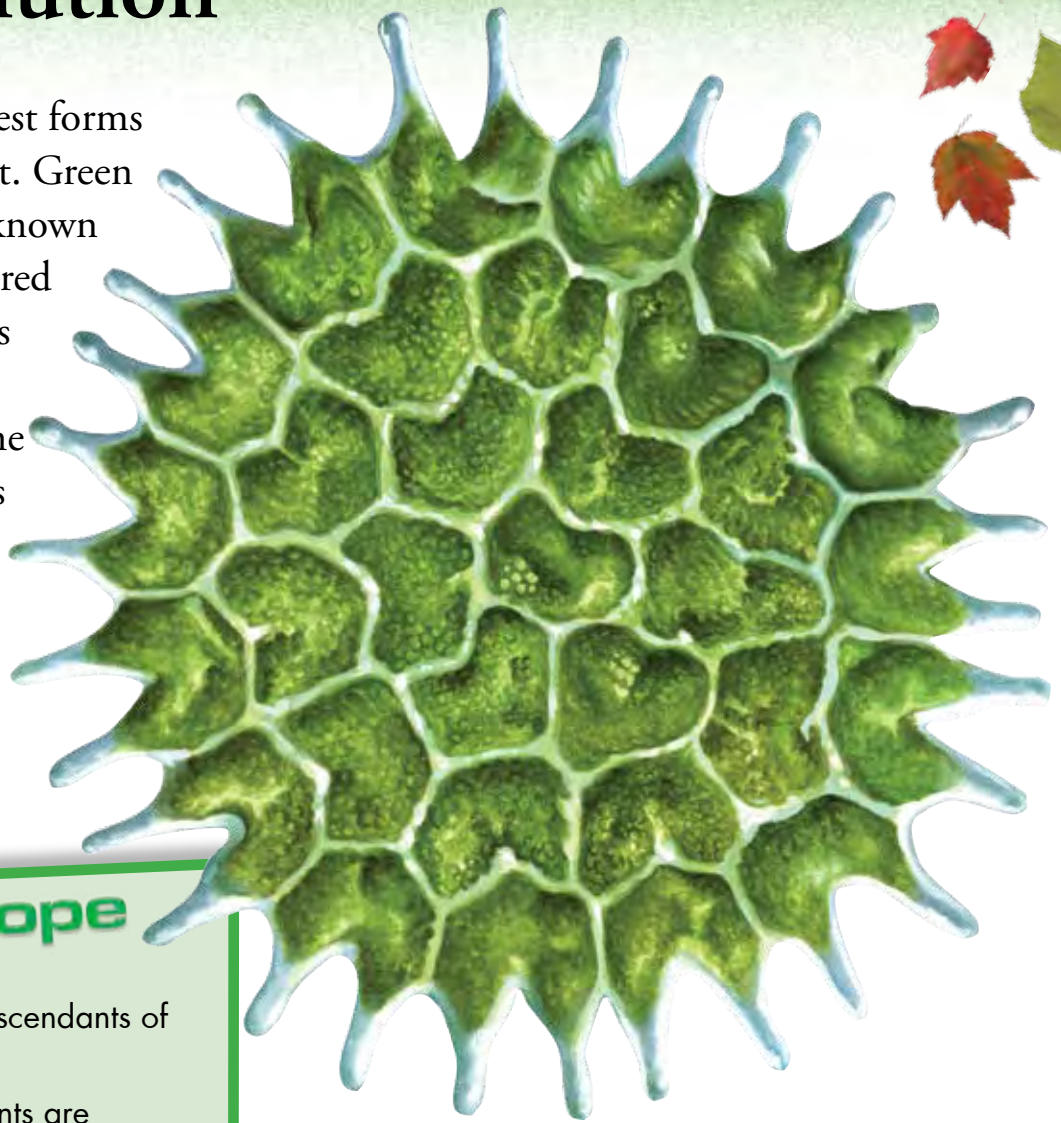
- Have eukaryotic cells
- Have cell walls
- Have different types of cells
- Exhibit photosynthesis
- Are capable of living on land

## Plant Kingdom is Divided into 12 Divisions.

Divisions in Plant Kingdom	Common Name
Hepaticophyta	liverworts
Anthoceropyta	hornworts
Bryophyta	mosses
Psilophyta	whisk ferns
Lycophyta	clubmosses
Sphenophyta	horsetails
Pterophyta	ferns
Coniferophyta	conifers
Cycadophyta	cycads
Ginkgophyta	Maidenhair tree
Gnetophyta	—
Anthophyta	flowering plants

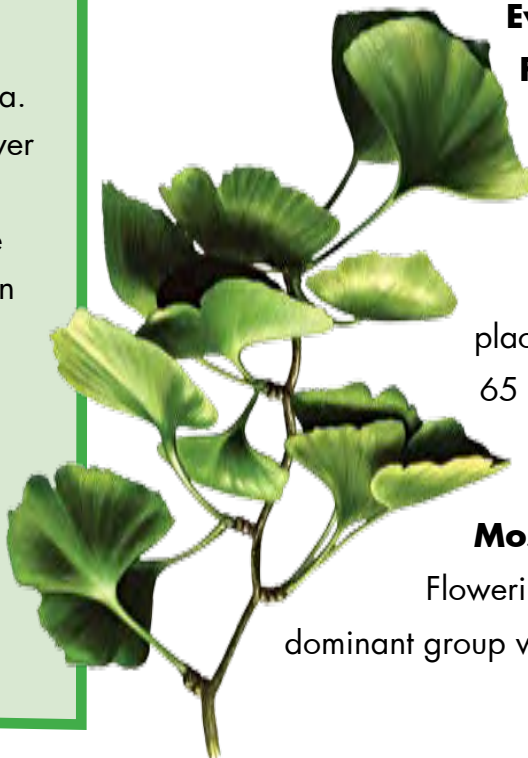
# Plant Evolution

Plants were the earliest forms of life on the planet. Green algae were the earliest known green plants that appeared about 500 million years ago. Flowering plants first appeared during the Jurassic and Cretaceous periods. Over millions of years, they eventually developed into modern plants.



## fact scope

- All land plants are descendants of green algae.
- The very first land plants are mosses and liverworts, evolved around 400 million years ago.
- Liverworts and mosses are the simplest living land plants.
- The first land plant was cooksonia.
- Ferns and tree ferns appeared over 300 million years ago.
- Horsetails grew in swamps in the period of development of ferns on land.
- Cycads spread on earth over 200 million years ago.
- Conifers appeared about 150 million years ago in tree form.
- Gingko is the only surviving plant of its division.



## Evolution of Flowering Plants

The evolution of primitive flowering plants to the modern flowering plants took place over a period of 65 million years.

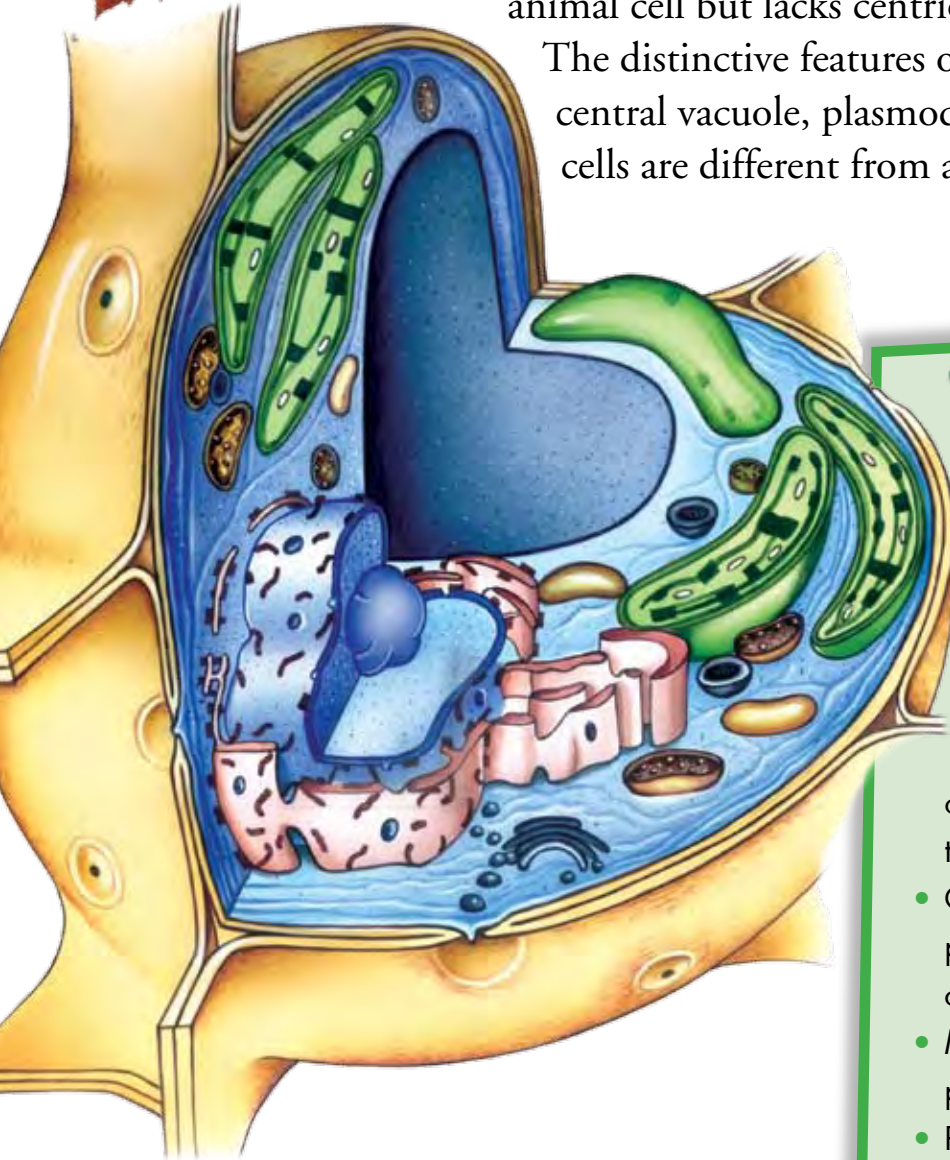
## Most Dominant

Flowering plants are the most dominant group with 250,000 species.



# Plant Cell

The plant cell is the functional and structural unit of a plant. A plant consists of billions and trillions of plant cells. A plant cell is similar to an animal cell but lacks centrioles, lysosomes, cilia, or flagella. The distinctive features of a plant cell are the cell wall, central vacuole, plasmodesmata, and chloroplasts. Plant cells are different from animal cells.

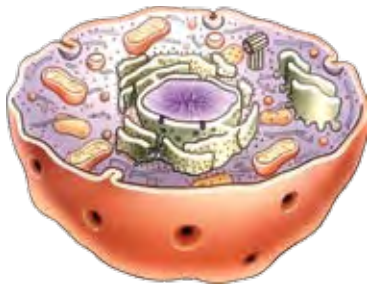


## fact scope

- Cells have functional organelles and a nuclei inside the membrane.
- The cell wall protects the cell and many other functions.
- Endoplasmic reticulum helps in the manufacturing and transporting of the chemical compounds across the cell.
- Golgi apparatus process the proteins and fats produced in the cell.
- Mitochondria work in the production of energy.
- Plasmodesmata connect plant cells to each other.
- The plasma membrane regulates the transfer of molecules in and out of the cells.
- The nucleus of cell stores the genetic material and regulates the growth and cell division.
- Chloroplasts are the special organelles. They work in the process of photosynthesis.

## Plant Cells Are Different From Animal Cells

Plant cells lack centrioles and have a cell wall, plastids, and large vacuoles unlike animal cells.



## Ribosomes

Ribosomes are small organelles that synthesise proteins.



# Plant Hormones

Plant hormones are chemicals that the plant uses to regulate its growth and development. Plant hormones are secreted at specific locations inside the plant. They are defined as signal molecules that are found in very low concentrations.

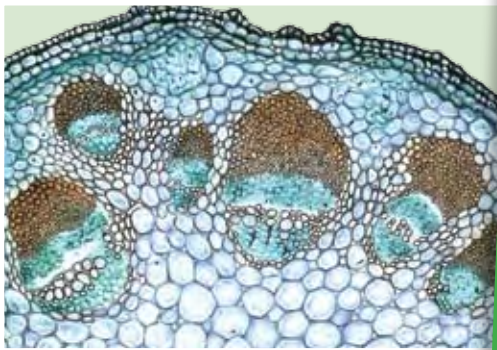
## Plant Development

Plant development is the changing of one growth stage to another.



## Plant Growth

Plant growth is the increase in number of leaves and size of stem.



## fact scope

### Absciscic acid

- Stimulates closing of stomata
- Inhibits shoot growth

### Auxin

- Stimulates cell elongation
- Stimulates differentiation of phloem and xylem

### Cytokinins

- Stimulates cell division
- Stimulates bud formation

### Ethylene

- Stimulates growth and differentiation of root and shoot
- Stimulates opening of flower and ripening of fruit

### Gibberellins

- Stimulate stem elongation
- Stimulates enzyme production

# Plant Body

Plants have six main parts: root, stem, leaf, flower, fruit, and seed. The stem or shoot is the main body of a plant. Roots usually grow underground. Flowers are the reproductive organs.

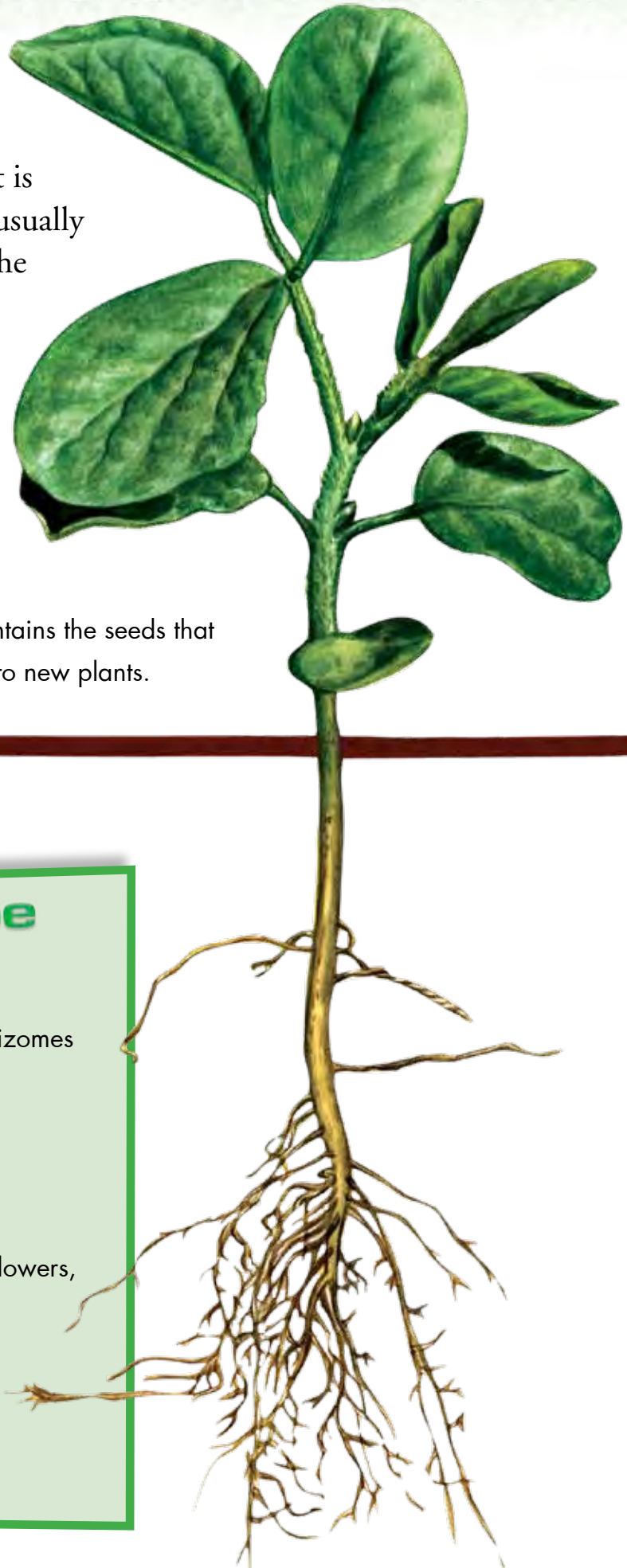


## Leaves

Leaves are the powerhouses of plants. They make food for the plants by using sunlight and water.

## Fruit

Fruit contains the seeds that grow into new plants.



## fact scope

### Root system

- Includes roots, tubers, and rhizomes
- Anchors the plant in soil
- Stores food
- Absorbs water and nutrients
- Conducts water and nutrients

### Shoot system

- Includes stem, leaves, buds, flowers, and fruits
- Rises the plant above soil
- Conducts water and food
- Functions in photosynthesis
- Functions in reproduction



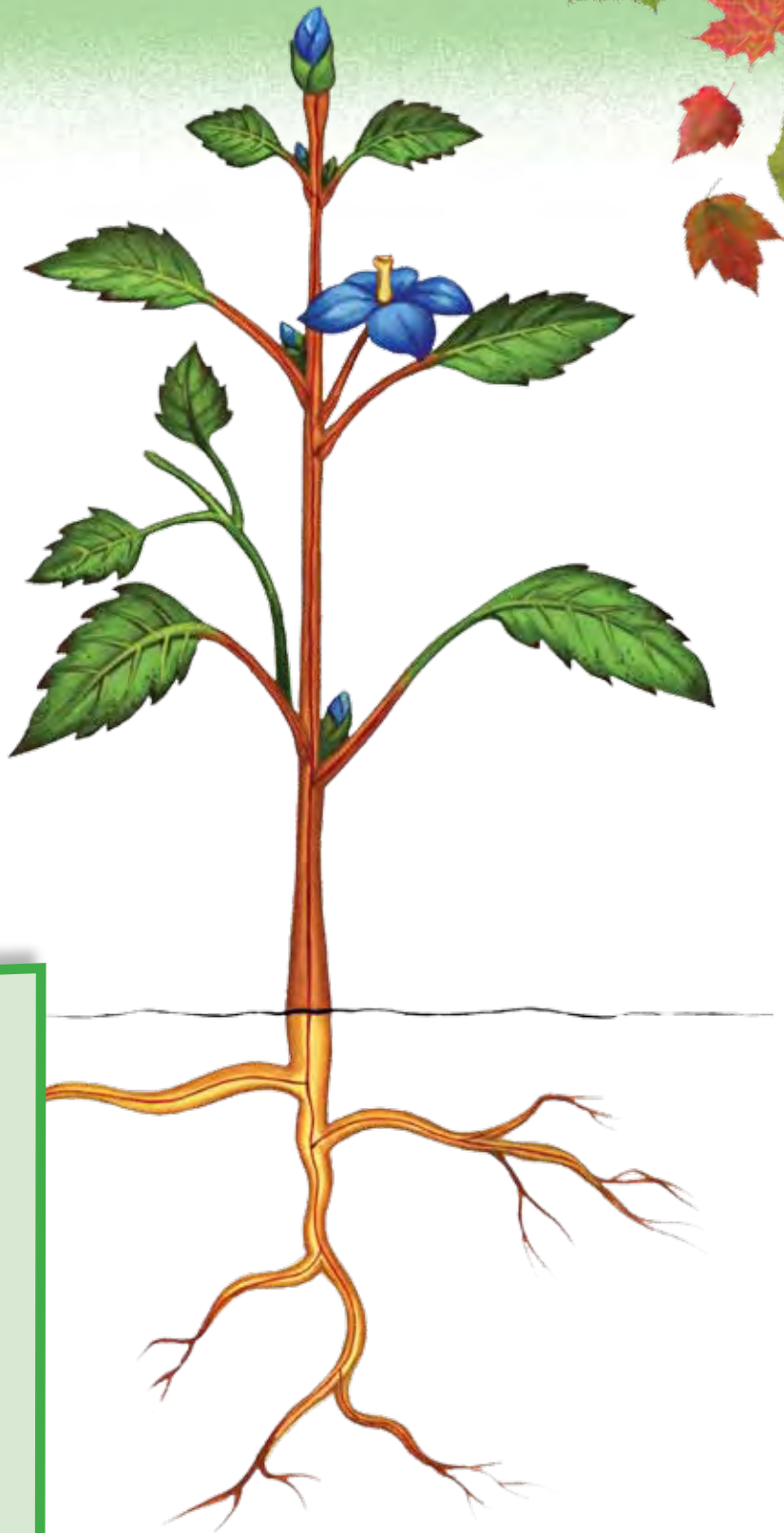
# Roots

**R**oots anchor a plant to the ground. They absorb water and nutrients from the soil. Roots also store food produced by plants. They usually grow underground but in many plants, they grow above the ground.



## fact scope

- Root hairs cover the roots and absorb water and minerals.
- Roots are responsible for the transport of water and substances from roots to stem and food from stem to roots.
- The root cap is a small cap at the end to protect the root tip.
- The process of germination leads to the growth of first root.
- Roots are the sensory network in plants and help to regulate plant growth.
- Roots are chemical factories.
- Roots can filter toxins out of the plant.



### Root Development

- Seed germinates
- Radicle grows out of the embryo
- Radicle develops into the first root
- In dicots, the radicle may develop into a thick taproot with branch roots
- In monocots, the radicle may develop adventitious roots



# Types of Roots

There are two basic types of root systems. They are the primary root system and the adventitious root system. The primary root system has a main root or a taproot that grows vertically down into the soil. The carrot is an example of a taproot. Adventitious roots grow from the stem or leaves. Banyan trees have adventitious roots.



## Taproot System

Nut trees, carrots, radishes, parsnips, and dandelions have taproot systems.



## Special roots

- Nodal roots
- Aerial roots
- Prop or stilt roots
- Buttress or Tabular roots
- Contractile roots
- Haustorial root
- Strangling roots
- Root tubers

## Adventitious Root System

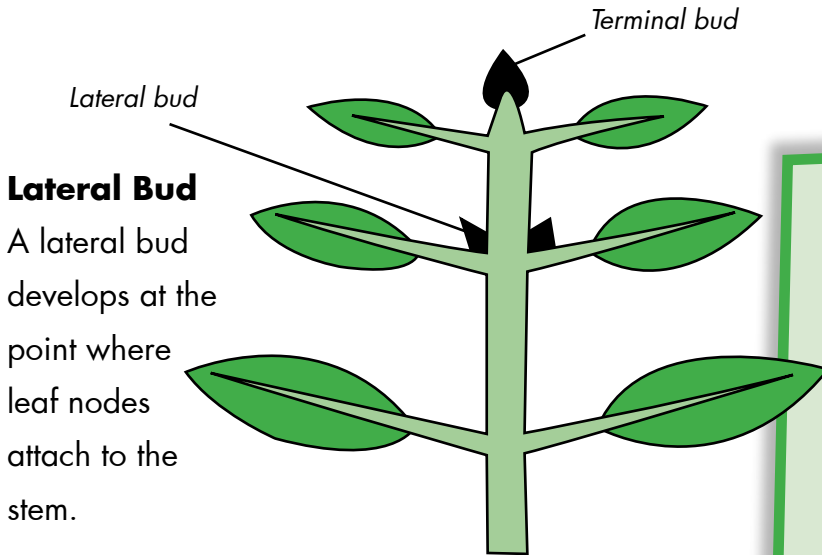
Maize, banyan, screwpine, blackberry, and philodendron have adventitious root systems.





# Stems

The stem is the main body of a plant. The stem provides support to the plant and helps in transportation of fluids between the roots and the shoots. It bears the buds, leaves, and flowers. An aerial stem of an adult tree is called a trunk.



## Lateral Bud

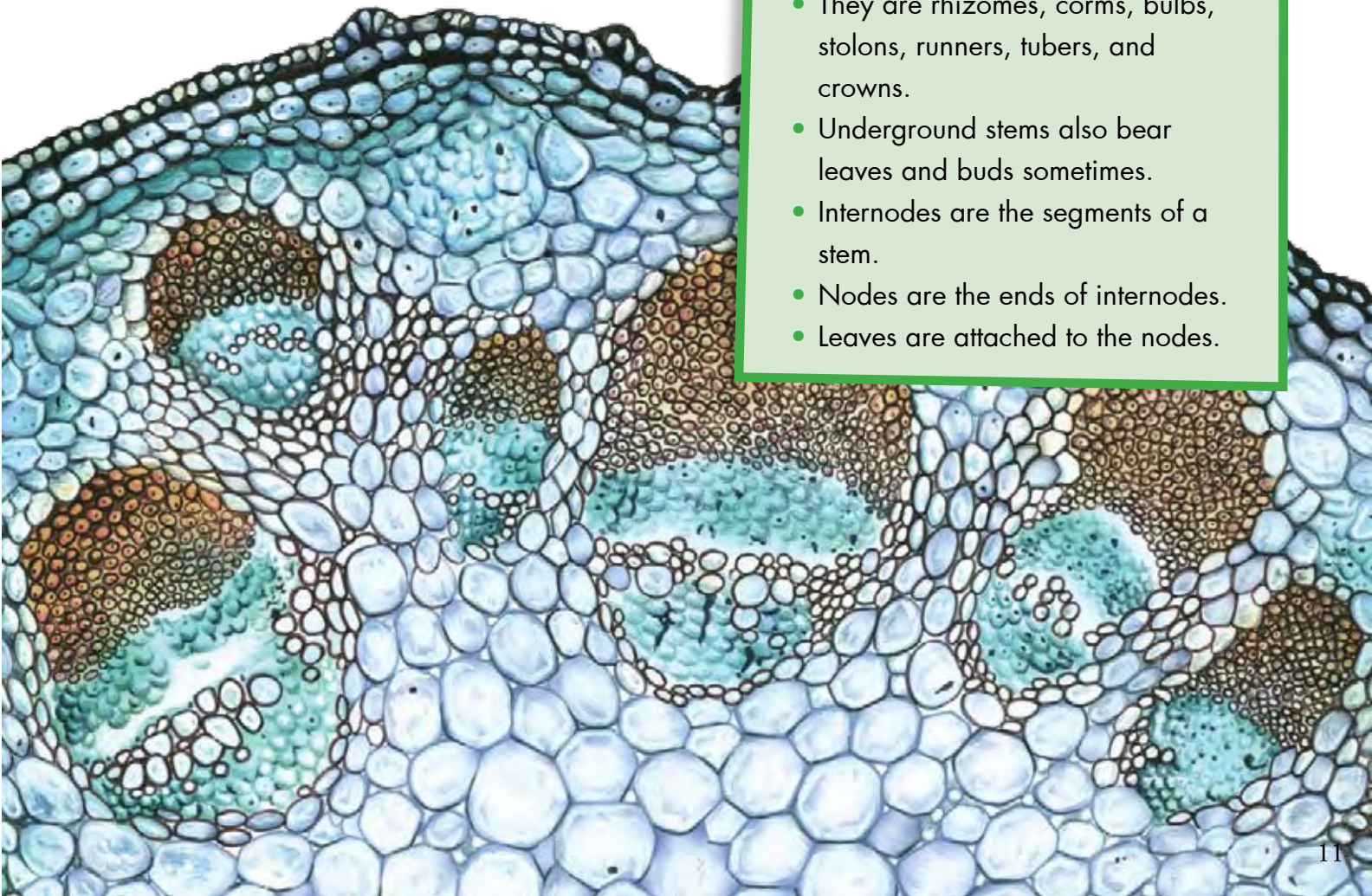
A lateral bud develops at the point where leaf nodes attach to the stem.

## Terminal Bud

A terminal bud develops at the tip of each stem.

## fact scope

- The structure of stems is more complex than that of roots.
  - Stems have a bigger circumference than roots.
- Stems also serve as a storage organ.
- Stems grow upright.
- Some stems grow under the ground or on the ground.
- They are rhizomes, corms, bulbs, stolons, runners, tubers, and crowns.
- Underground stems also bear leaves and buds sometimes.
- Internodes are the segments of a stem.
- Nodes are the ends of internodes.
- Leaves are attached to the nodes.





# Inside Stems

Stems usually are made up of three types of tissues, the dermal tissue, ground tissue, and vascular tissue. The outermost dermal tissue protects the stem and helps in gaseous exchange. The ground tissue consists mainly of parenchyma cells and is photosynthetic in nature. The vascular tissues provide structural support to the plant.

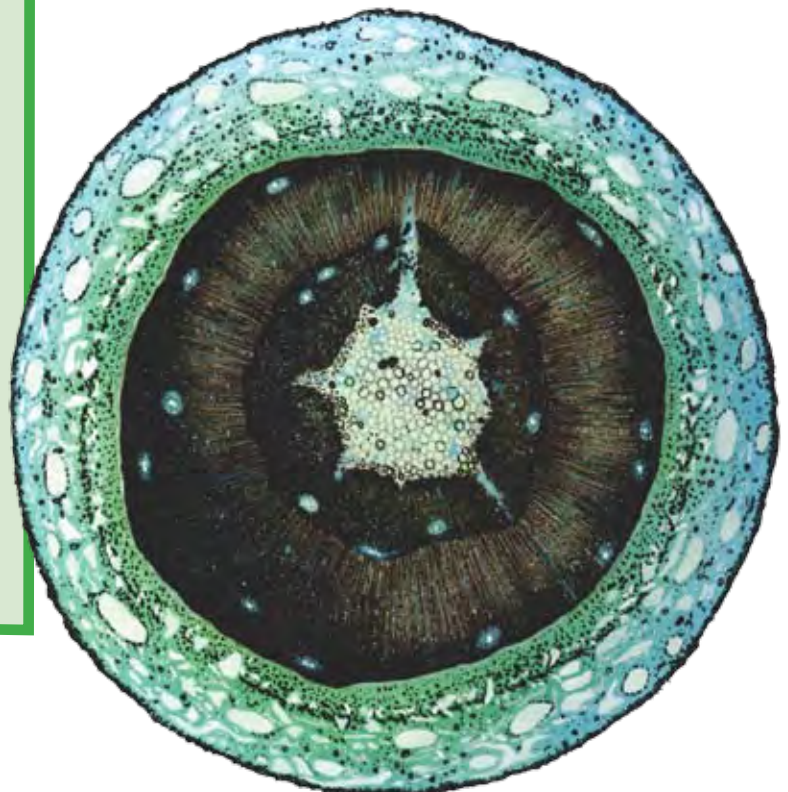


## fact scope

- Stems transport water and nutrients throughout the plant.
- Stems have internal tubes that act as vessels.
- Xylem are tissues that conduct water.
- Phloem are tissues that conduct food.
- Xylem and phloem extend from leaves to roots.
- Xylem is composed of dead cells.
- Phloem consists of sieve tubes and companion cells.
- Sometimes toxins are stored in stems and are used to fight the microorganisms.

## Production of Xylem and Phloem

Xylem and phloem tissues are produced by meristematic cambium cells.

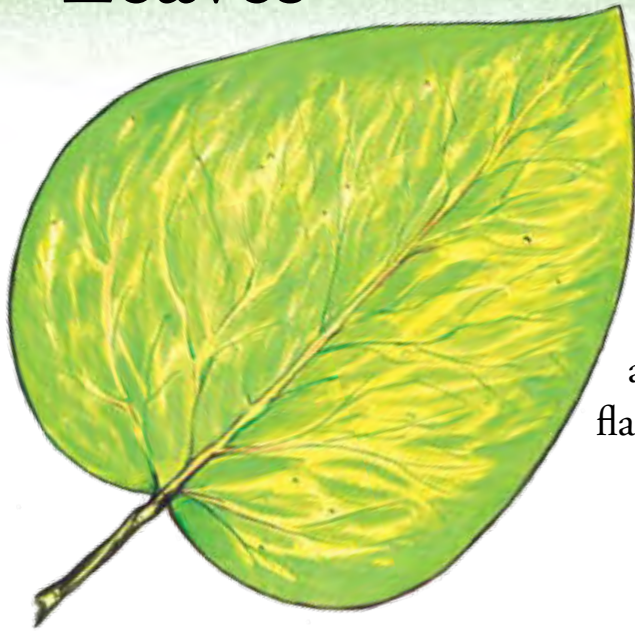


## Cambium

Cambium is a layer of cells inside the bark that produces wood.



# Leaves



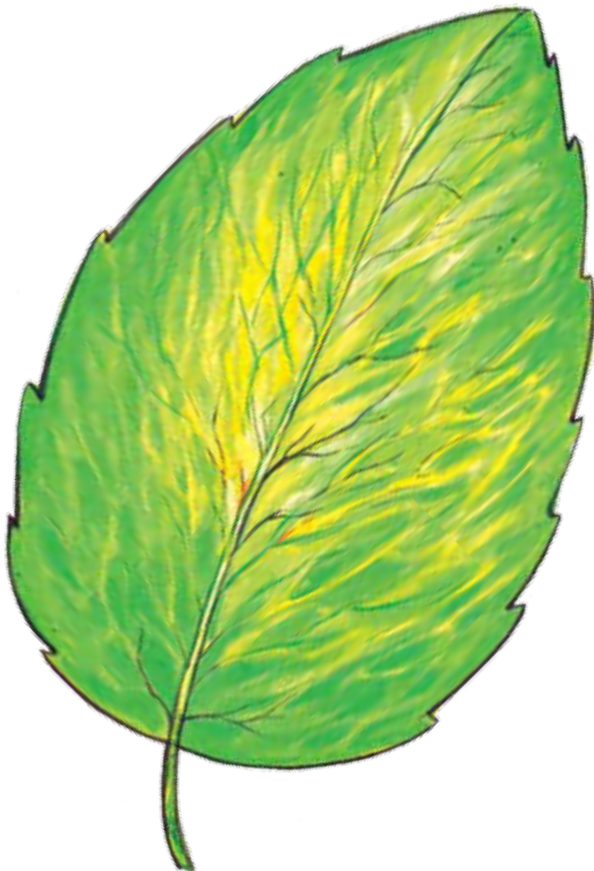
**L**eaves perform the most vital function of photosynthesis. They are the primary organs of food production in plants. They develop from structures known as leaf primordial, which are actually extensions of the shoot. Leaves are usually flat and thin and can store food and water.

## Chlorophyll

Chlorophyll is present in leaves inside the chloroplasts of cells.

## Modified Leaves

Leaves are modified to form long, needle-like or rolled or hairy leaves to withstand unfavorable conditions.



- Leaves are attached to stems by a stalk known as petiole.
- The flat part of a leaf is called leaf blade.
- The flat and broad structure helps in absorbing sunlight.
- The base and apex of a leaf is connected by a central leaf vein known as the midrib.
- The upper layer of leaf is the protective waxy layer known as the cuticle.
- Guard cells are paired cells that control the opening and closing of stomata.
- Stomata are leaf pores present on the underside of the leaves.
- Stomata help in absorption of carbon dioxide.
- Stomata also help in the process of transpiration.

# Photosynthesis

Photosynthesis is the process by which plants make carbohydrates using water, carbon dioxide, and sunlight. Photosynthesis occurs in the leaves of green plants. The leaves of green plants contain a green pigment called chlorophyll, which helps in photosynthesis. Photosynthesis has two stages: light reaction and dark reaction.



## Chlorophyll

Chlorophyll converts the light energy into chemical energy.



## Photosynthesis

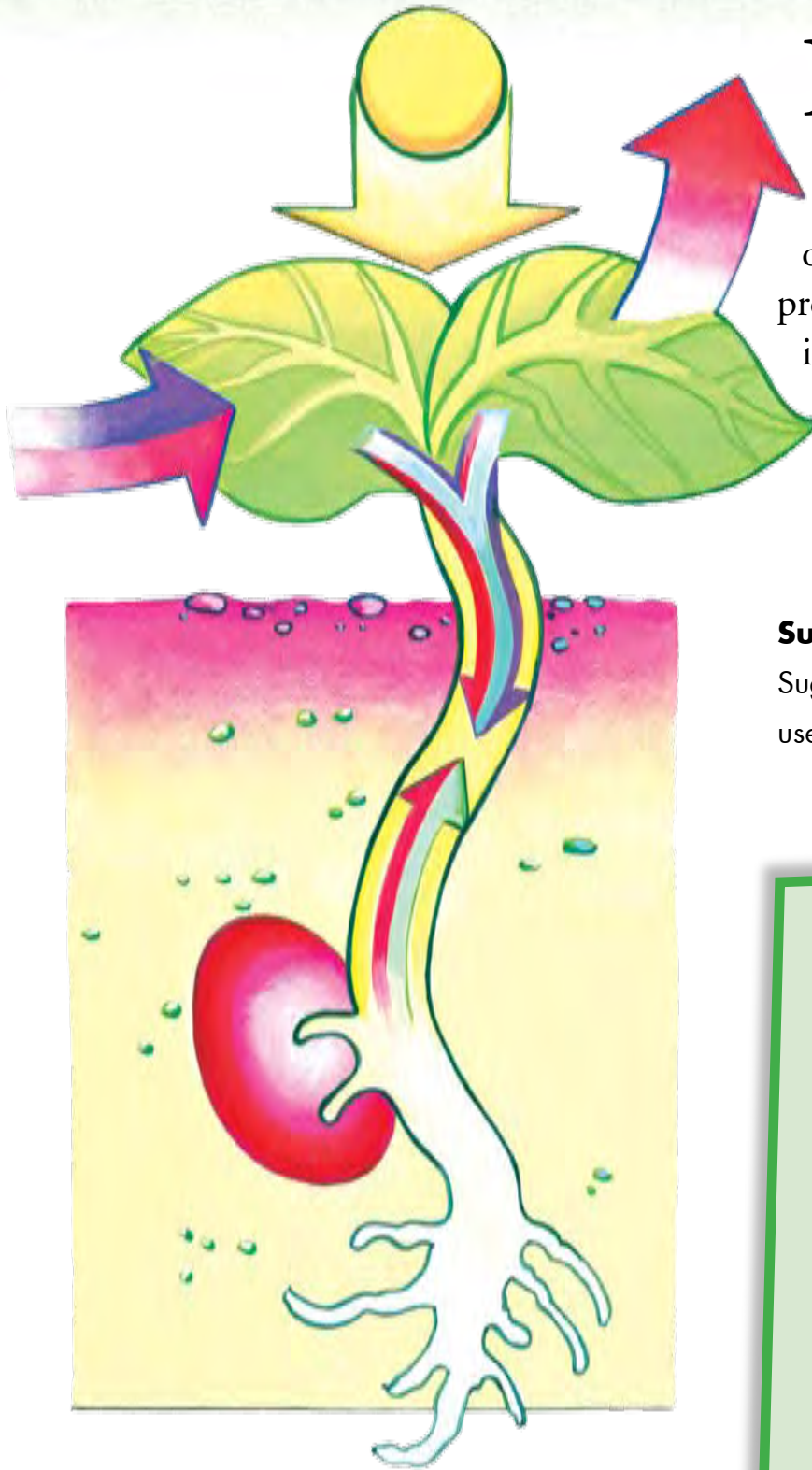
Photosynthesis produces organic molecules that are useful to all living organisms.



- Photosynthesis takes place in the chloroplasts of plant leaves.
- Sunlight provides the energy for the process.
- Temperature, carbon dioxide level, light intensity, and wavelength affects the process.
- Pigments are chemical compounds that reflect certain wavelengths of visible light.
- Pigments are useful to plants in making food.
- Plants that make their food are known as autotrophs.
- The oxygen we breathe is made by plants during photosynthesis.
- The leaves take in carbon dioxide and release oxygen.



# Foods for Plants



## Oxygen

Oxygen is the byproduct of photosynthesis.

Plants need food like other living things to live. Plants make their food with the help of sunlight, water, and air. The process of making food takes place in the leaves of plants. Plants use glucose, a kind of sugar, as food for energy and growing.

## Sugar

Sugar is stored in the form of starch that is used later by breaking down.

## fact scope

- Only green plants can make their food.
- Chlorophyll is the pigment that makes the plants green.
- The first phase of making food requires sunlight.
- Sunlight breaks down water into hydrogen and oxygen.
- The hydrogen, carbon, and oxygen are converted into compounds.
- These compounds are converted into stable organic compounds, glucose and water.
- The sugar produced is transported around the plant.



# Flowers

Flowers are the reproductive organs of plants. Flowers bear fruit that contain seeds. The colorful part of a flower is called the corolla, while calyx is the green, outermost part of a flower. The male and female reproductive parts are called stamen and pistil. They produce fruit that contain seeds.

## fact scope

- Flowers that have both male and female parts are known as complete flowers.
- Flowers with only male or female parts are known as incomplete flowers.
- The stigma is a part of the pistil that receives the pollen.
- The ovary is the swollen part of a pistil that contains ovules.
- The style connects the ovary and stigma.
- Plants like the century plant and agave bloom only once and die out.
- The plant puya raimondii flowers when it is 150 years old.
- All bamboo plants of the same species flower at the same time.
- Caucasian lime flowers are poisonous to bees.
- The white flowers of the Amazon water lily are white and turn purple after pollination.



### Smallest Flower

Wolffia duckweed of Australia is the smallest flower. It is just .02 inches in size.

### Biggest Flower

Rafflesia is 3.28 feet in diameter, weighs 24.25 pounds, and grows in jungles of Borneo and Sumatra.



# Pollination

Pollination is the early phase in the reproduction of plants. It is the transfer of pollen from the male to the female part of a flower. Pollination is carried out by various external agents like wind, insects, water, and animals. Pollination can occur within the same flower or between two flowers.

## fact scope

- Fertilization takes place after pollination.
- Plants like poppies, peonies, and roses produce pollen but not nectar.
- The evening primrose emits ultraviolet light to attract insects.
- Colorful petals, nectar, scent, and sticky pollen are used to attract insects.
- Plants of the grass family are pollinated by wind.
- Some plants like protea and hooked pincushion are pollinated by mice.
- Wind-pollinated plants do not have colorful petals and scents.
- Pollen grains can live for only a few hours to several weeks.
- Orchids allow only one type of insect to pollinate them.

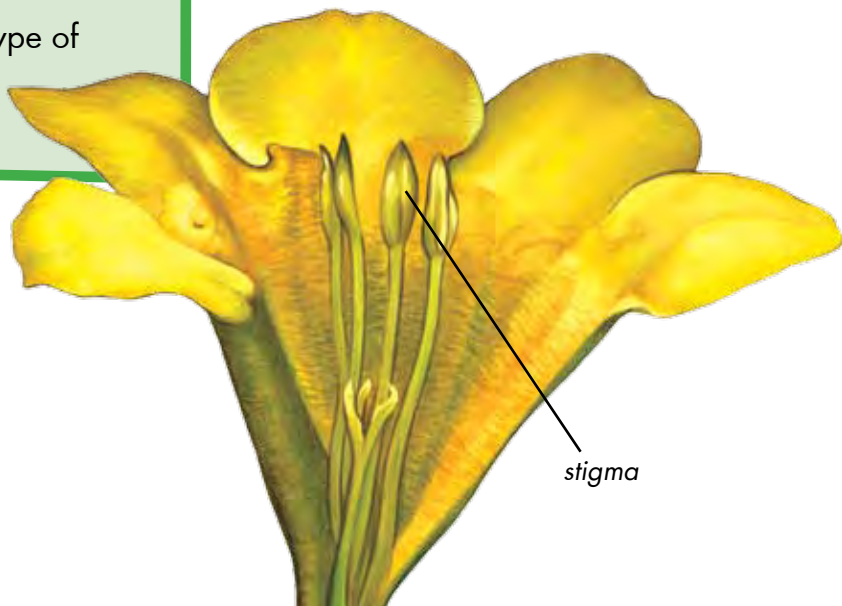


### Cross-pollination

In cross-pollination, the pollen goes from an anther to stigma to another plant of the same kind.

### Self-pollination

In self-pollination, the pollen goes from an anther to stigma on the same plant.





# Fruits

Fruit is the ripened ovary of a flowering plant.

They can be fleshy like tomatoes or dry like coconuts.

There are different types of fruits: simple, aggregate, or multiple. Simple fruits are formed in flowers with one ovary such as pea. Aggregate fruits are formed in flowers with many ovaries like raspberries. Pineapples are multiple fruit formed from the ovaries of many flowers borne on single plant.



## fact scope

### Simple fruits

- Peanuts
- Sunflower seeds
- Grain (corn, barley, rice)
- Acorns
- Walnuts
- Tomatoes
- Grapes
- Citrus fruits
- Apples

### Aggregate fruit

- Strawberries

### Multiple fruit

- Mulberry
- Osage orange



### Fruits Known as Vegetables

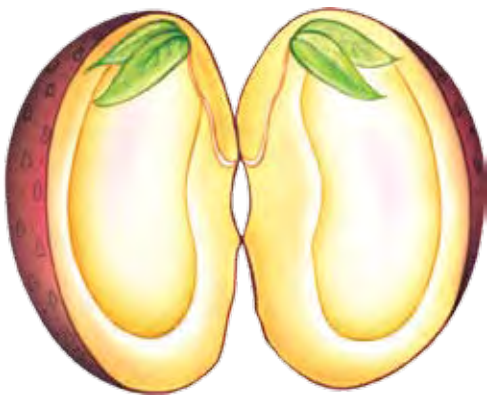
Fruit like tomatoes, squash, cucumbers, corn, and eggplant are commonly known as vegetables.

### Vegetable Known as a Fruit

Rhubarb is the only vegetable commonly known as a fruit.

# Seeds

Seeds are ripened ovules. A single fruit can have one or more seeds. Seeds consist of the embryo, a protective seed coat, and stored food called the endosperm. Seeds of flowering and non-flowering plants are different.

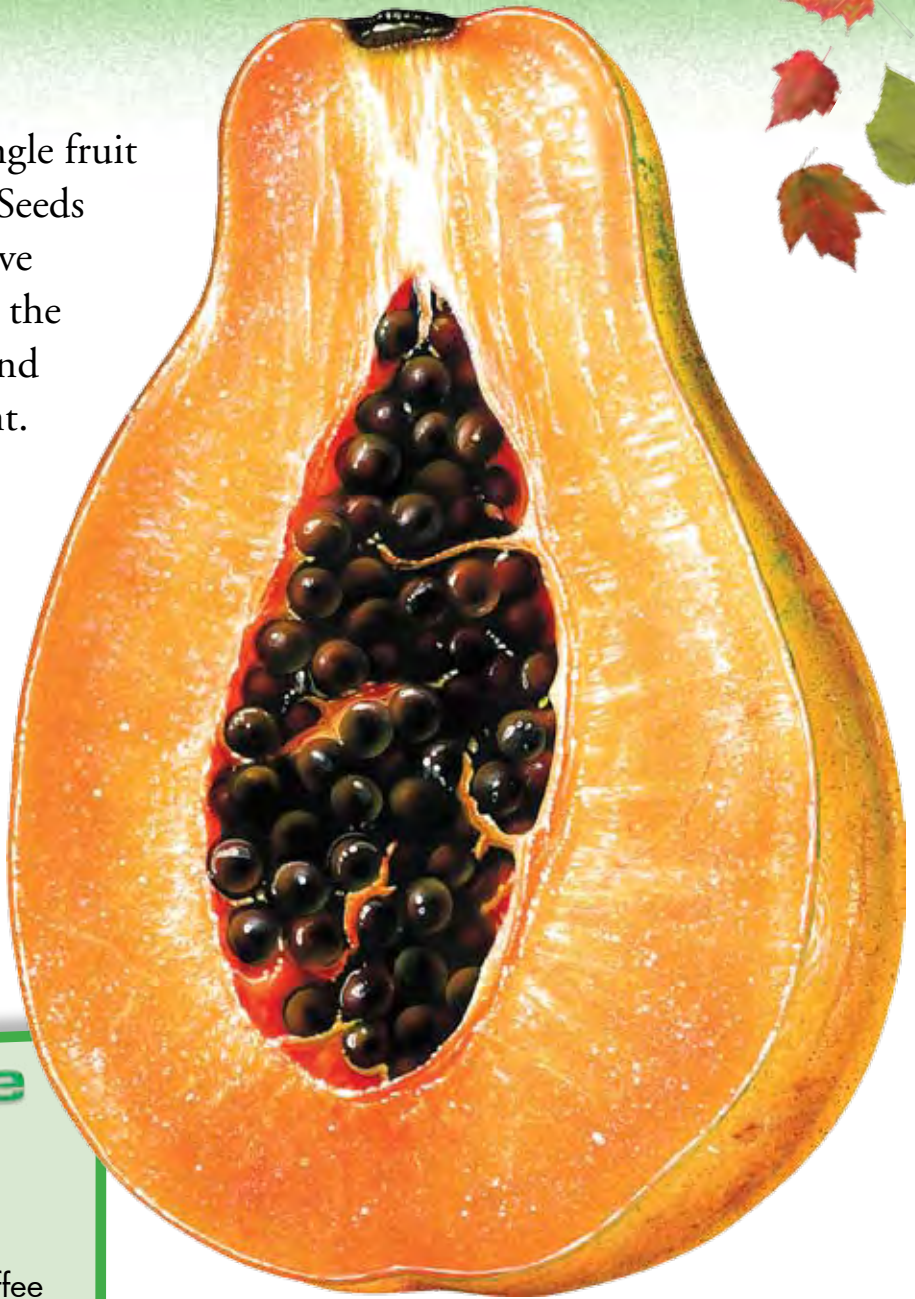


## fact scope

- Seeds are covered with a hard shell known as testa.
- Cereals, pulses, wheat, and coffee are seeds of plants.
- The seedpods of orchids hold 3 million seeds.
- Conifers, cycads, and ginkgos bear naked seeds.

### Dispersal of seeds

- Heavy seeds fall off.
- Winds carry off seeds to different places.
- Animals help in dispersal of seeds.
- Water often acts as carrier of seeds.



### Largest Seed

The double coconut is the largest seed that measures up to 19.68 inches.

### Giant Redwood

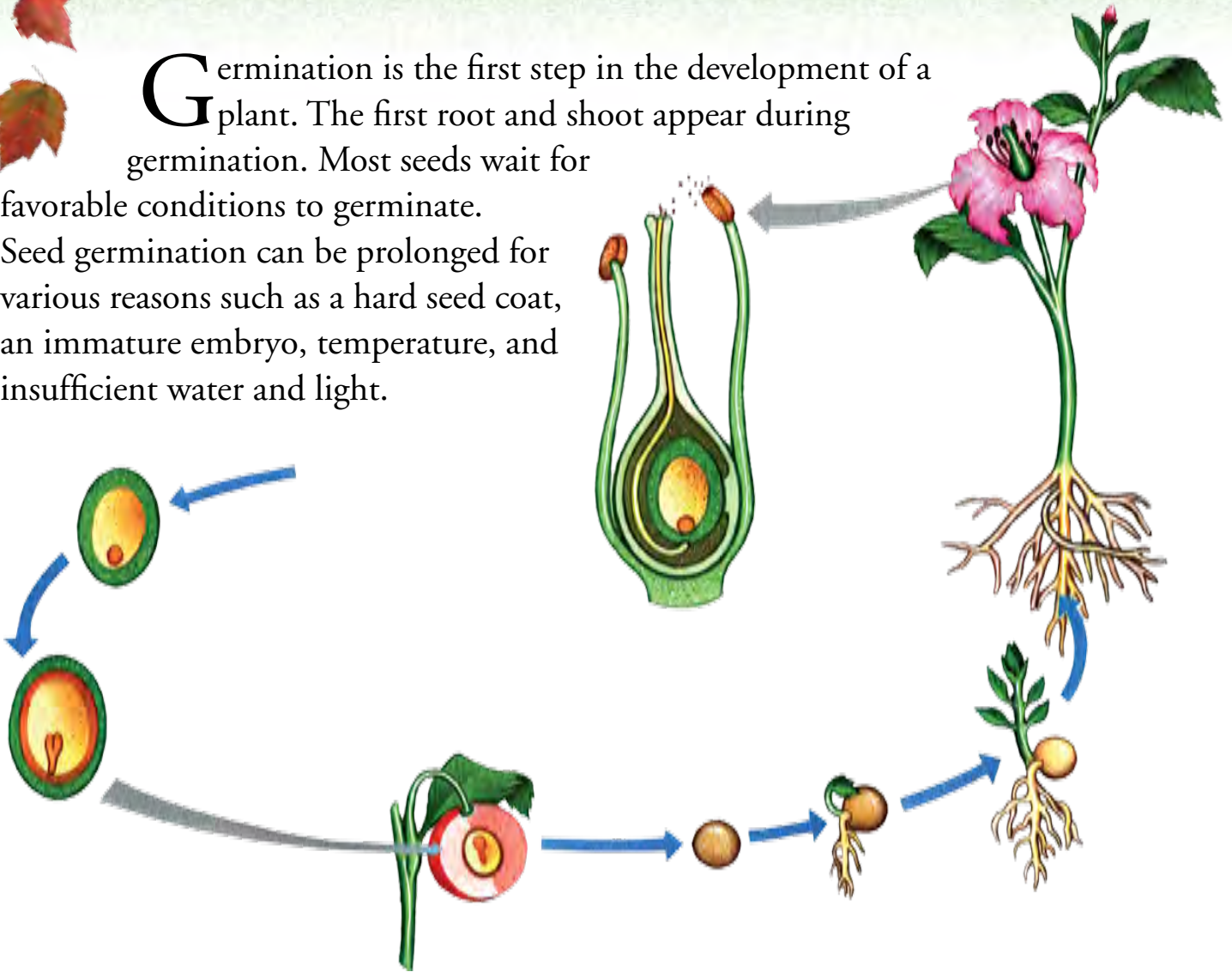
The giant redwood tree grows from tiny seeds that are less than .07 inches long.





# Germination

Germination is the first step in the development of a plant. The first root and shoot appear during germination. Most seeds wait for favorable conditions to germinate. Seed germination can be prolonged for various reasons such as a hard seed coat, an immature embryo, temperature, and insufficient water and light.



## fact scope

### Conditions for germination

- Water
- Oxygen
- Optimum temperature
- Proper light

### Process

- Seeds absorb water and oxygen through the seed coat
- Cells of embryo enlarge
- Seed coat breaks
- Radicle comes out
- Shoot comes out consisting of leaves and stem

### Darkness

Some seeds require darkness to germinate.

### Poor Germination

Overwatering and dry conditions can cause poor germination.



# Flowering Plants

Flowering plants are a major group of plants in the plant kingdom. Flowering plants are called angiosperms. They are the largest group of plants with 250,000 known species. Flowering plants are divided into dicotyledons and monocotyledons.

## Largest Family

The sunflower family is the largest family with 24,000 species.

### fact scope

- The orchid family has 20,000 species.
- The pea family has 18,000 species.

Important flowering plants

Grass family

- Rice
- Corn (maize)
- Wheat
- Barley
- Rye
- Oats
- Millet
- Sugar cane

Rose family

- Apples
- Pears
- Cherries
- Apricots
- Plums



## Marine Flowering Plants

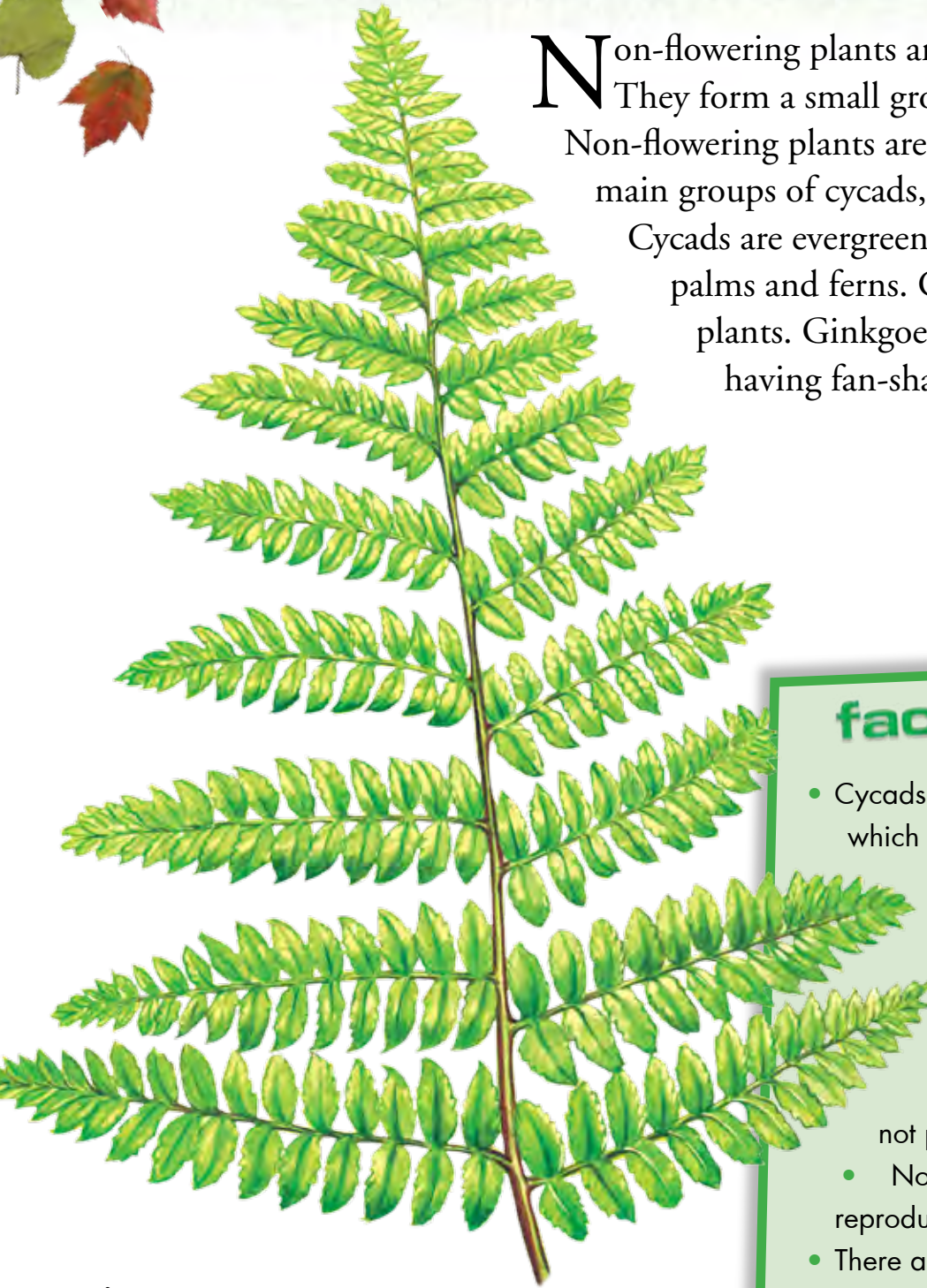
Marine flowering plants are found in the oceans of the world or the tropical regions.





# Non-Flowering Plants

**N**on-flowering plants are called gymnosperms. They form a small group of only 700 species. Non-flowering plants are divided into the three main groups of cycads, conifers, and ginkgoes. Cycads are evergreen plants, which look like palms and ferns. Conifers are evergreen plants. Ginkgoes are deciduous trees having fan-shaped leaves.



## Pines

Pines are coniferous evergreen trees. Most pine trees bear male and female cones on the same tree.

## Ginkgo

The ginkgo tree is different from other plants on earth. They produce male and female cones on separate trees.

## fact scope

- Cycads are evergreen plants, which look like palms and ferns.
  - Conifers are evergreen plants.
  - Ginkgoes are deciduous trees having fan-shaped leaves.
  - Non-flowering plants do not produce seeds.
- Non-flowering plants reproduce with spores.
- There are 150 species of cycads.
- Conifer and yew bear seeds in cups.
- Sago palms have branched or un-branched trunks and some have underground stems with leaves above the ground.

# Monocots

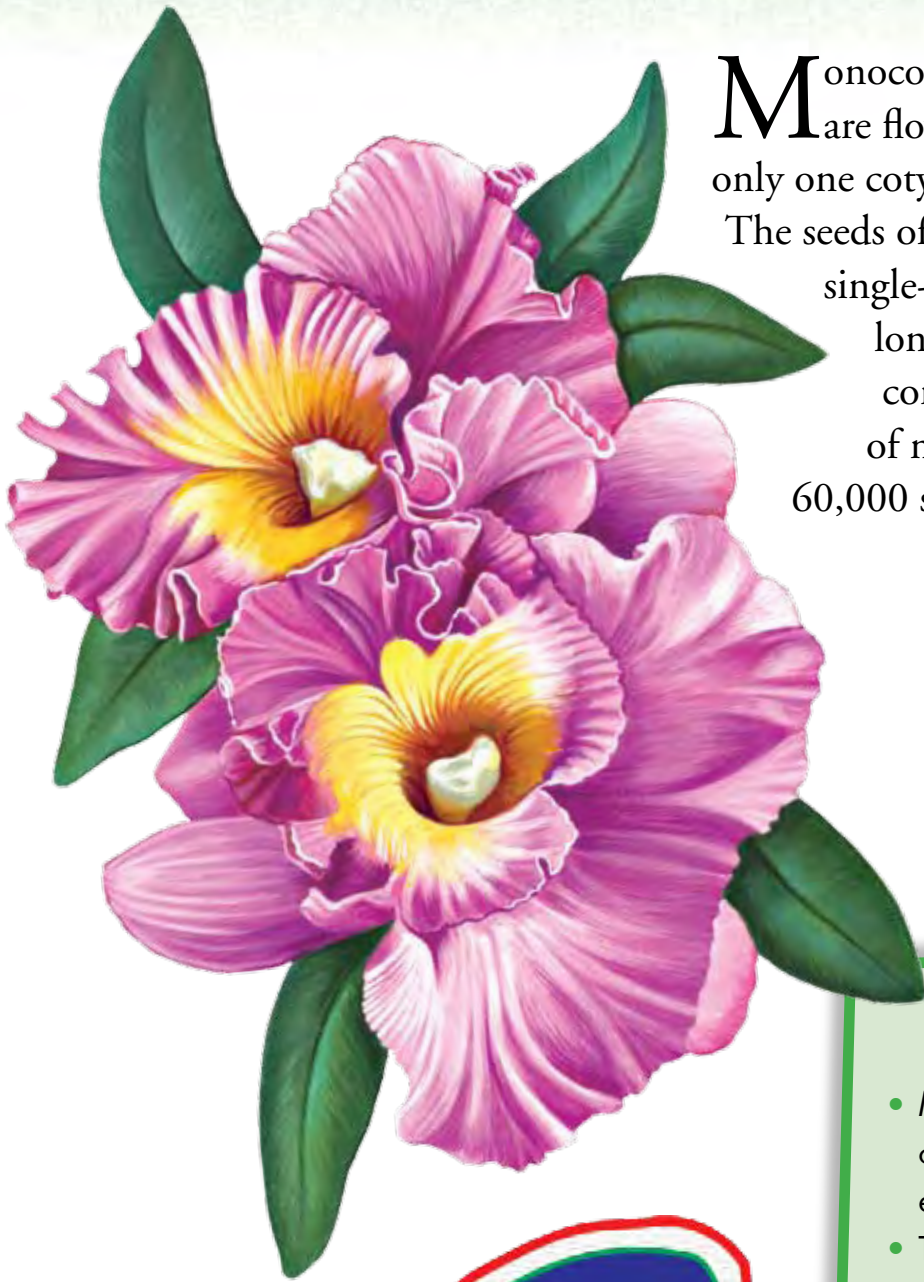
**M**onocotyledons or monocots are flowering plants that have only one cotyledon in their seeds.

The seeds of monocots are

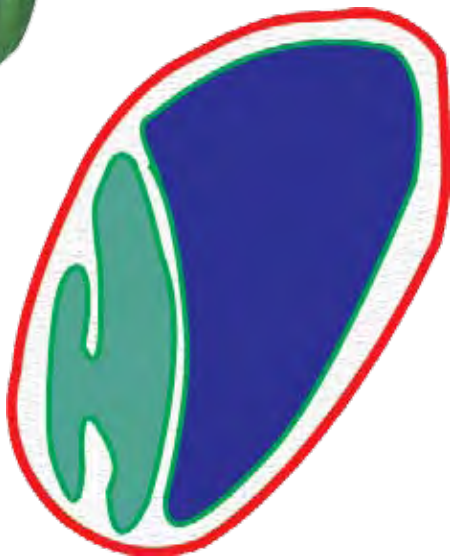
single-leafed. Monocot plants have long, narrow leaves. Grasses, palms, corns, and orchids are examples of monocots. There are about 60,000 species of monocots.

## Liliopsida

Monocots are also known as liliopsida.



*Monocot seed structure*



## Flowers

The flower part of monocots are set in three or multiples of three.

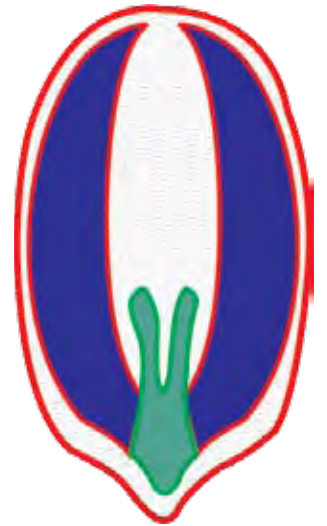
## fact scope

- Monocots are the most important organisms on Earth in terms of ecology.
- They include some of the largest and most familiar groups of plants, including lilies, orchids, agaves, palms, and grasses.
- Sugar cane, pineapples, dates, bananas, and many of our familiar tropical fruits also come from monocots.
- Monocot stems have scattered vascular bundles.
- Orchids are the largest family in this group.



# Dicots

**D**icotyledons or dicots are flowering plants that have two cotyledons in their seeds. The seeds of dicots are two-leaved. Flowers and vegetables that have broad shaped leaves are dicots. There are about 200,000 species of dicots. Other examples of dicots are peas, buttercups, or shrubs.



*Dicot seed structure*



## **Magnoliopsida**

Dicots are also known as magnoliopsida.

## **Flowers**

Flowers of dicots are set in groups of four or five.

## **fact scope**

### Dicots include

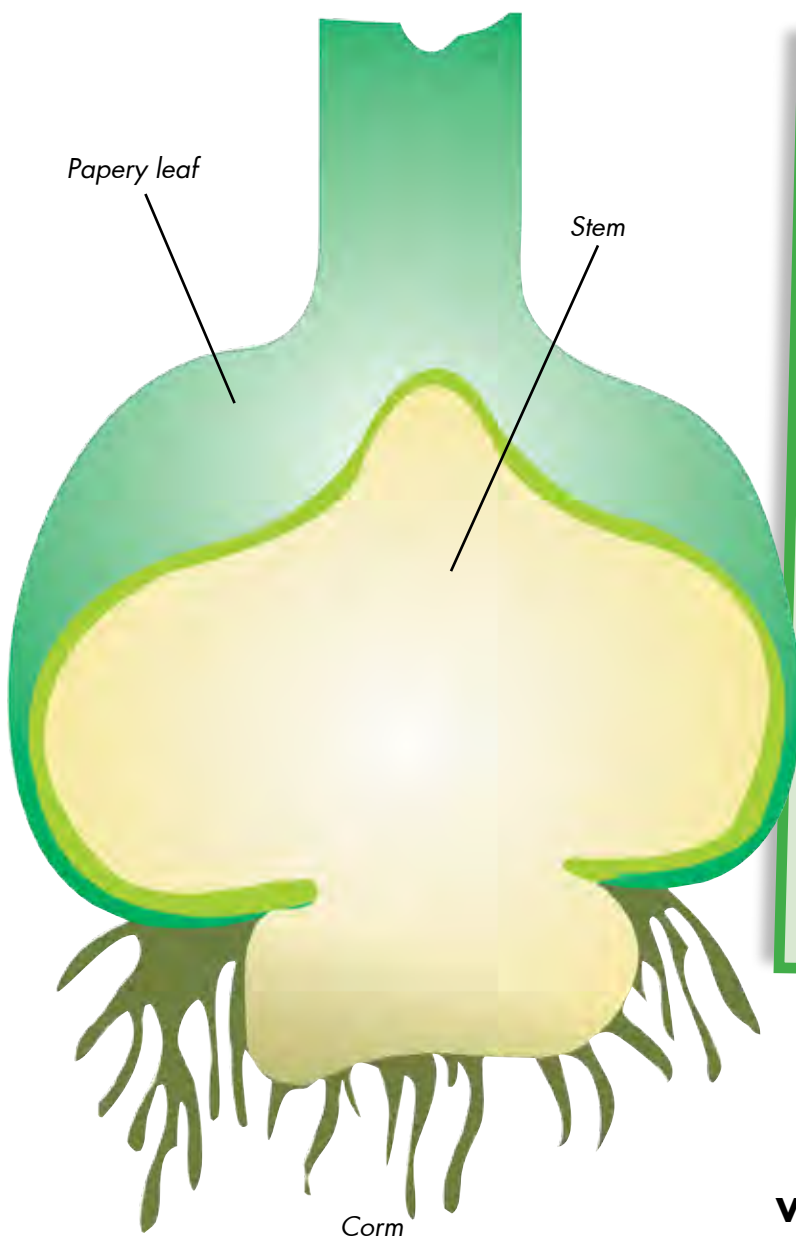
- Garden plants
- Trees
- Flowers like magnolia, rose etc.

### Ornamental dicots

- Ficus
- Hedera
- Polyscias
- Poinsettia
- Vine family

# Asexual Reproduction in Plants

Asexual reproduction takes place in plants without seeds or spores. During asexual reproduction a clone of the parent plant is created. Grafting, budding, or using cuttings are various methods of asexual reproduction. There are two types of asexual reproduction: vegetative reproduction and apomixis.



## fact scope

- Mostly stems are used for asexual reproduction.
- Underground stems like bulbs, tubers, corms, and rhizomes are also used.
- Dandelion uses its roots for asexual reproduction.
- Poplar grows new stems from roots.
- Citrus trees use their seeds for the asexual reproduction.
- Rhizomes help in the spreading of irises and day lilies.
- Asexual reproduction helps in keeping desirable traits.
- Grafting helps in the reproduction of shrubs like apple.

### Apomixis

Apomixis is the growth of an embryo from egg cells without fertilization.

### Vegetative Reproduction

Vegetative reproduction involves stolons, runners, bulbils, etc.



# Ferns

Ferns are green, non-flowering plants that are found all over the world.

They are among the oldest land plants. They are about 400 million years old. Ferns do not produce seeds but reproduce with the help of spores. They grow in warm, damp, and shady places. There are about 9,000 to 12,000 species of ferns worldwide.

## fact scope

- Ferns belong to the group of feather plants.
- Tree ferns have woody trunks without branches.
- Ferns have clusters of feathery leaves.
- Several ferns have leaves that grow directly from underground stems.
- Ferns are present everywhere except the driest and coldest places.
- Ferns existed 100 million years before the development of flowering plants.
- Some ferns have tiny leaves of only .39 inches.
- The leaves of ferns are known as fronds.
- Tree ferns of the tropics grow up to a height of 82 feet.
- Some ferns grow on leaves or stems of other plants.



### Bird's Nest Fern

The leaves of the bird's nest fern are long and narrow and form a bowl-shaped plant.

### Examples of Ferns

- Bladder ferns
- Buckler ferns
- Lady ferns
- Oak ferns



# Mosses

Mosses are simple non-flowering plants. They are among the oldest land plants and existed even before ferns. They usually grow on soil, rocks, shallow streams, and the bark of trees. They are found on forest floors and appear to carpet the floor.

## Examples of Mosses

- Bog moss
- Rock moss
- True moss



## fact scope

- Mosses are rootless plants.
- Mosses are adapted to dry conditions.
- Mosses cannot survive in polluted air.
- Mosses have no system for carrying water from the soil to other parts of the plant.
- Mosses can reproduce asexually.
- Mosses require abundant water for growth and reproduction.

## Mosses and Deciduous Trees

Mosses grow mostly on deciduous trees because deciduous trees have less acidic bark.





# Club Mosses

Club mosses are small evergreen plants. However, they were as large as trees about 354 million to 290 million years ago. Club mosses are more like ferns than real mosses. They have small, needle-like leaves that are often spirally arranged. They reproduce with the help of spores. There are about 200 species of club mosses.



## Lycopodium

*Lycopodium clavatum*, a species of the club moss family is used as a flammable powder in fireworks.



## fact scope

- Club mosses are creeping plants.
- They are terrestrial, epiphytic flowerless plants.
- Club mosses were dominant in the Carboniferous period.
- They contributed to the coal deposits we find today.
- Club mosses reproduce through spores.
- The spores form a group that looks like a cone.
- Club mosses are more advanced than other mosses as they have fluid conducting tissues.
- They are generally found in moist places, like tropical and subtropical forests.
- Club mosses are used as Christmas decorations.

## Examples of Club Mosses

- Fir club moss
- Hybrid Alpine club moss
- Interrupted club moss
- Issler's club moss

# Liverworts

Liverworts are small non-flowering plants. There are two major types of liverworts: thallose liverworts and leafy liverworts. Leafy liverworts look very much like mosses. They usually grow in damp, shady environments, such as moist cliffs, rotten logs, and banks of streams. There are about 6,000 species of liverworts worldwide.



## Examples of Liverworts

- Crescent-cup liverwort
- Dumortier's liverwort
- Great Scented liverwort
- Hemispheric liverwort



## Thalloid Liverworts

Thalloid liverworts shrink in dry conditions and reappear in rainy conditions.

### fact scope

- Liverworts are the simplest true plants.
- Leafy liverworts are very small plants.
- They have minute scale-like leaves on hair-like stems.
- Thallose liverworts look like a ribbon and are green in color.
- The first liverworts developed during the Devonian era, 400,000,000 years ago
- Liverworts are anchored with simple appendages known as rhizoids.
- They do not have conducting tissues.
- The liverworts shrink in dry conditions because of the lack of stomata.
- The leaves of leafy liverworts do not have a midrib.
- The sporophyte of liverworts shrinks after the release of spores.



# Hornworts

Hornworts are small non-vascular plants like liverworts. Hornworts lack leaves and stems. They are named so for their horn-like appearance. They are found throughout the world. They usually grow in places that are damp or humid.



## Examples of Hornworts

- Carolina hornwort
- Dotted hornwort
- Field hornwort
- Smooth hornwort

## fact scope

- Hornworts have horn-like spore producing stalk.
- The stalk releases spores after the maturation of spores.
- Hornworts belong to the division Anthocerophyta.
- There are around 100 species of hornworts.
- Hornworts form dense colonies.
- Hornworts look like thallose liverworts.
- They evolved around 380 million years ago.
- Hornworts are found on tree trunks, riverbanks, etc. in tropical and temperate regions.

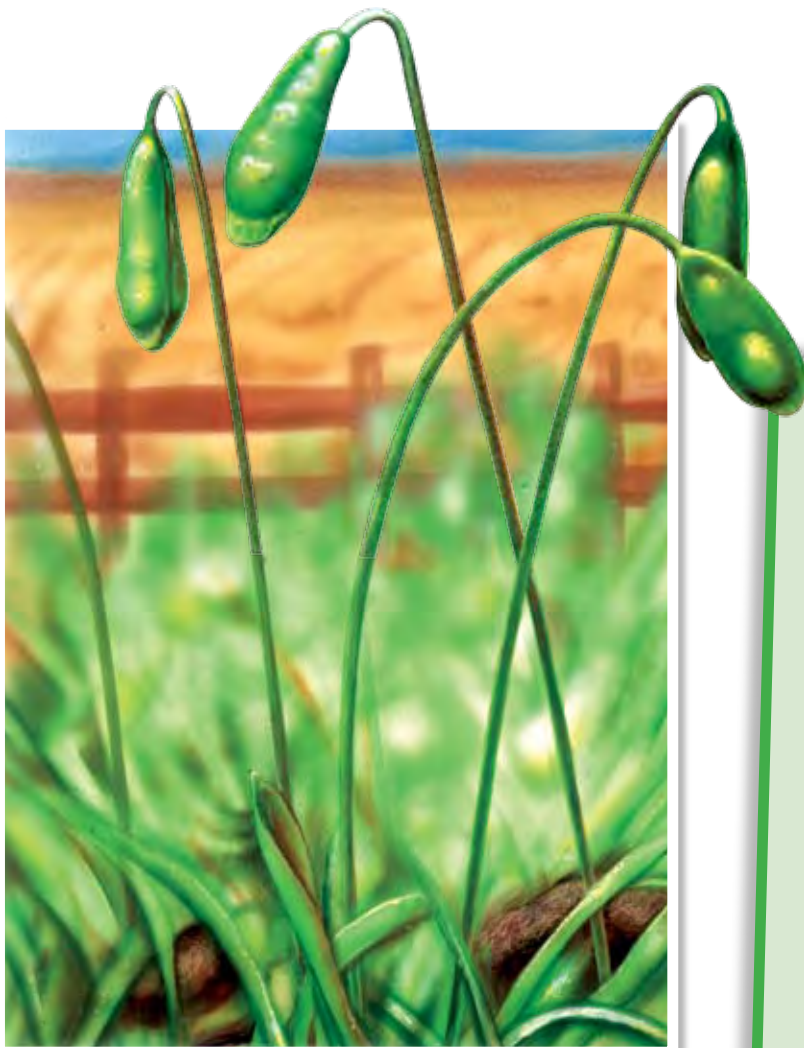
## Single Chloroplast

Each cell in hornworts has a single chloroplast unlike other plants.



# Horsetails

Horsetails are perennial non-flowering herbs. They have jointed hollow stems and narrow tooth-like leaves. They are found in wet, swampy soil. They are found throughout the world except Australia and Antarctica. Horsetails have medicinal properties and are used to soothe wounds, heal cuts, and stop bleeding. There are about 29 species of horsetails.



## Equisetum

Equisetum is the only surviving genus of horsetails.

### fact scope

- Horsetails are vascular plants.
- Horsetails developed in swamps at the time when ferns developed.
- The horsetails that survive nowadays are smaller than the ancient horsetails.
- Horsetails have tiny crystals of silica that give them a papery appearance.
- The stems produce foods.
- The stem is circled with papery scales that act as leaves.
- Horsetails reproduce through spores.
- The tips of the plant bear spore-bearing cones.

## Examples of Horsetails

- Water horsetail
- Branched horsetail
- Marsh horsetail
- Variegated horsetail





# Shrubs

Shrubs are low bushy plants. They are perennial plants with several stems. They usually grow in well-drained soil. Shrubs are found in almost all parts of the world. They are useful because they provide cover and food for birds and protect the soil from erosion. Some shrubs may have flowers and bear fruit.



## Hibiscus

Hibiscus is a flowering plant that has around 200–220 species. They are used as landscape shrubs.



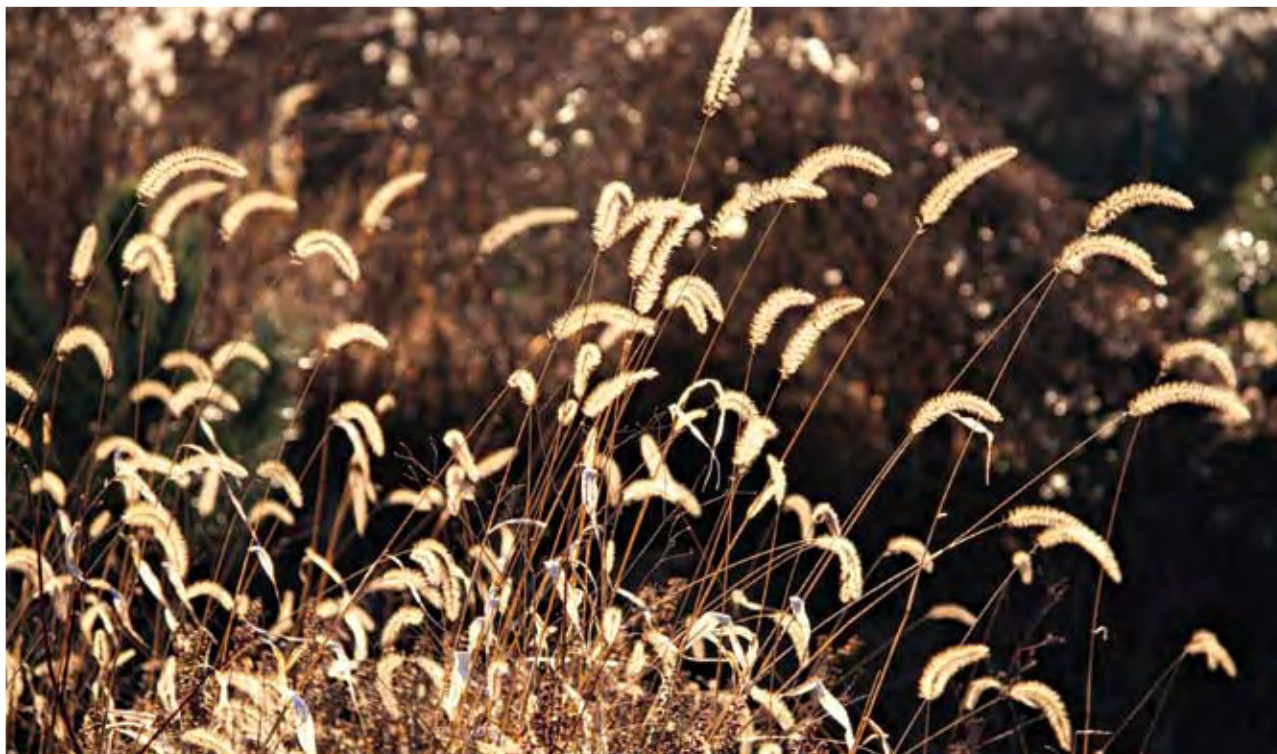
## Junipers

Junipers are evergreen, coniferous plants. They have needle-like or scale-like leaves.

## fact scope

- Shrubs are woody plants that are different from trees.
- They have multiple stems instead of a single trunk.
- Shrubs mature faster than trees.
- Some shrubs start flowering in the second or third year.
- Garden shrubs are broad-leafed plants.
- Shrubs are either deciduous or evergreen.
- Shrubs like periwinkle and lavender are small and are known as subshrubs.
- Arborescences or tree shrubs are intermediate between shrubs and trees.

# Weeds



**W**eeds are plants that grow very quickly. Weeds reproduce rapidly and in great numbers. Weeds are of two types: annual and biennial weeds. Annual weeds live just one season. Biennial weeds reproduce by seeds and live for two growing seasons.

## **Largest Weed**

Giant hogweed is the largest weed that grows to a height of 11.8 feet and has 3-foot leaves.

## **Stinging Nettles**

Stinging nettles are used in making herbal medicines. They are rich in vitamin C.



## **fact scope**

- Weeds grow in unwanted places.
- A single flower bears 350 seeds in weeds like cow parsley and wild carrot.
- The stems of wild clematis are 98.4 feet long and are climbing and sprawling.

Weeds grow anywhere because of

- Quick germination
- Effective defense systems
- Rapid growth
- Production of lots of seeds
- Survival of seeds for several years
- Multiplication in number





# Grass

**G**rasses are usually short plants with long, narrow and slender leaves. They are the fourth-largest group of plants in the plant kingdom. They grow in swamps, deserts, polar regions, hot tropical areas, rocky land, and on snowy mountains. There are about 9,000 species of grasses found worldwide.



## Examples of Grass

- Cup grasses
- Beard grasses
- Blue-eyed grasses
- Fern grasses
- Meadow grasses

## Attractive Grasses

Attractive grasses include ribbon grass, cordgrass, blue lyme grass, and many others.



## fact scope

- Grasses are 70 to 80 percent water.
- The roots of grasses account for 90 percent of the whole weight of grass.
- Sod-forming grasses reproduce from their root systems and also from seeds.
- Bunch grasses grow in bunches and reproduce from seeds.
- Cool season grasses grow in cool months.
- Warm season grasses grow in warm months.



# Vines

Vines are climbing plants. They have long, thin and flexible stems that help them to climb, twine, and creep along a surface. Most vines are flowering plants. Vines are of two types, woody vines or lianas, and herbaceous or non-woody vines.



## fact scope

- Guinea flowers are fast growing evergreen vines with large leaves up to 3 inches long.
- Virgin's bower is a woody vine with leaves that have jagged teeth.
- Climbing fig are often grown as container plants or most often in a greenhouse.
- Wild cucumber is also known as "manroot" because of its fleshy underground root.
- Bougainvillea was discovered by a French navigator in Brazil in 1768.
- Dodder is a parasitic plant that ranges in color from pink to yellow to cream.
- Western clematis grows in the open and is often used as an ornamental.

### Jasmine

Jasmine is a shrubby fragrant vine, easy to grow in sun but needs good drainage.



### Bignonia

Bignonia, trumpet flower, has tendrils and lies on roofs.



# Trees

Trees are large woody plants.

They have a distinct main stem or trunk.

Trees are perennial and may be monocots or dicots. There are about 70,000 species of trees all over the world. Trees grow mostly in places where there is adequate rainfall.

## fact scope

- Trees are found in different shapes and sizes.
- The shapes of leaves, fruits, seeds and flowers differ in all trees.
- Trees are a source of food, clothing, and shelter.
- Trees provide energy, medicines, and a variety of other products.
- Hardwood trees have hard wood.
- Softwood trees have soft wood.
- Trees help in purifying the air through photosynthesis.
- Some trees take 200 years to harvest.
- General Sherman in California is the biggest tree with a height of 272 feet and a width of 36 feet.
- The Mendocino redwood tree in California is the tallest tree with a height of 367 feet.

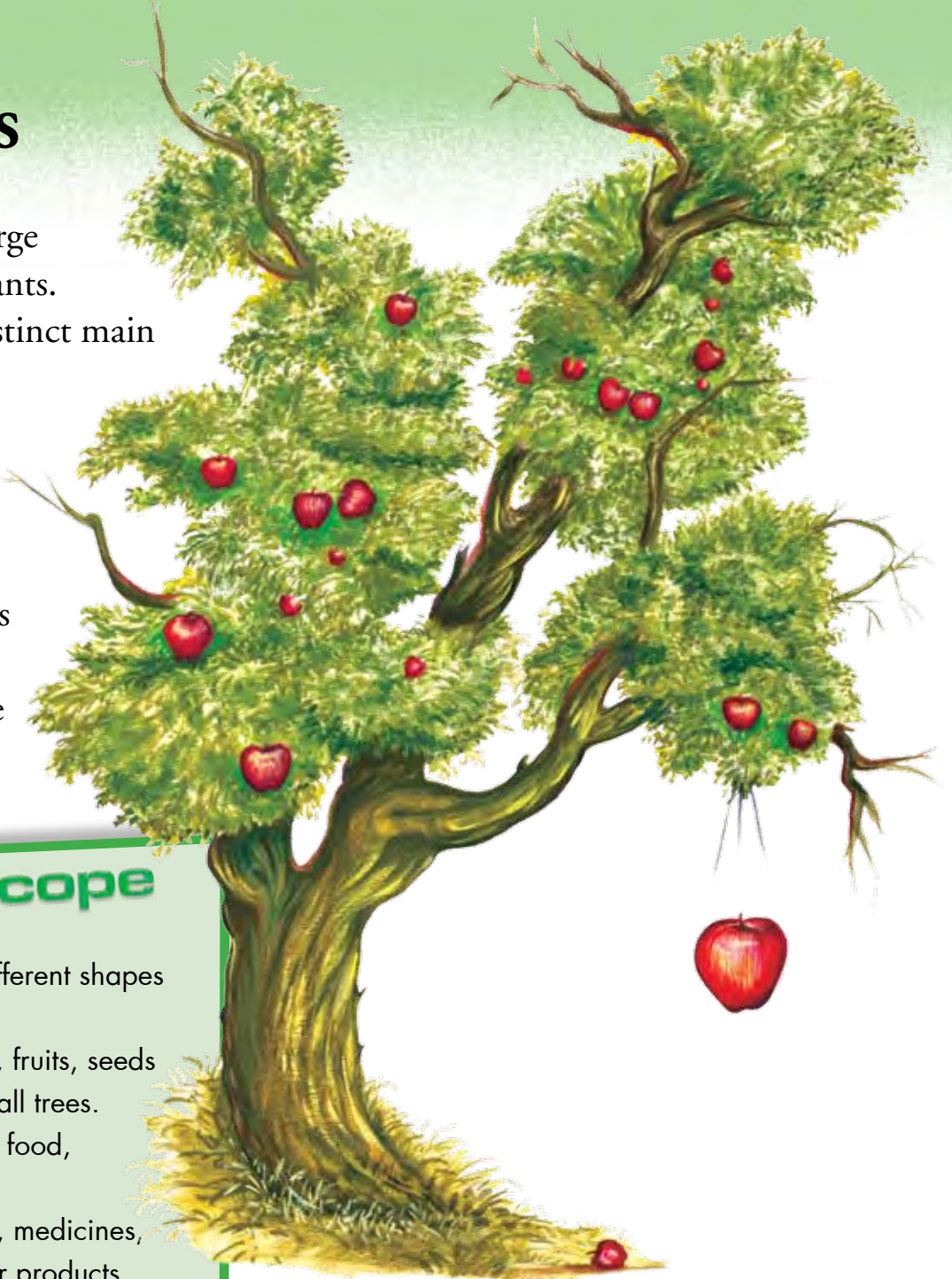
### Ombu Tree

The ombu tree in Argentina is the toughest tree that can survive fire, storms, and attacks of axes, and insects.



### Great Banyan Tree

The great banyan tree in the Indian Botanical Garden, Kolkata, covers an area of 2.96 acres.





# Evergreen Trees

Evergreen trees have leaves throughout the year. They grow new leaves before shedding the old ones. The leaves of evergreen trees are either needle-shaped or broad. Most evergreen trees, however, have broad leaves. Common evergreen trees include pine, fir, spruce, hemlock, cedar, cypress, and yew.

## fact scope

### Needle evergreens include

- Spruce
- Hemlock
- Pine
- Yew
- Cypress

### Broadleaf evergreens include

- Rhododendron
- Holly
- Oregon grape holly
- Mountain laurel

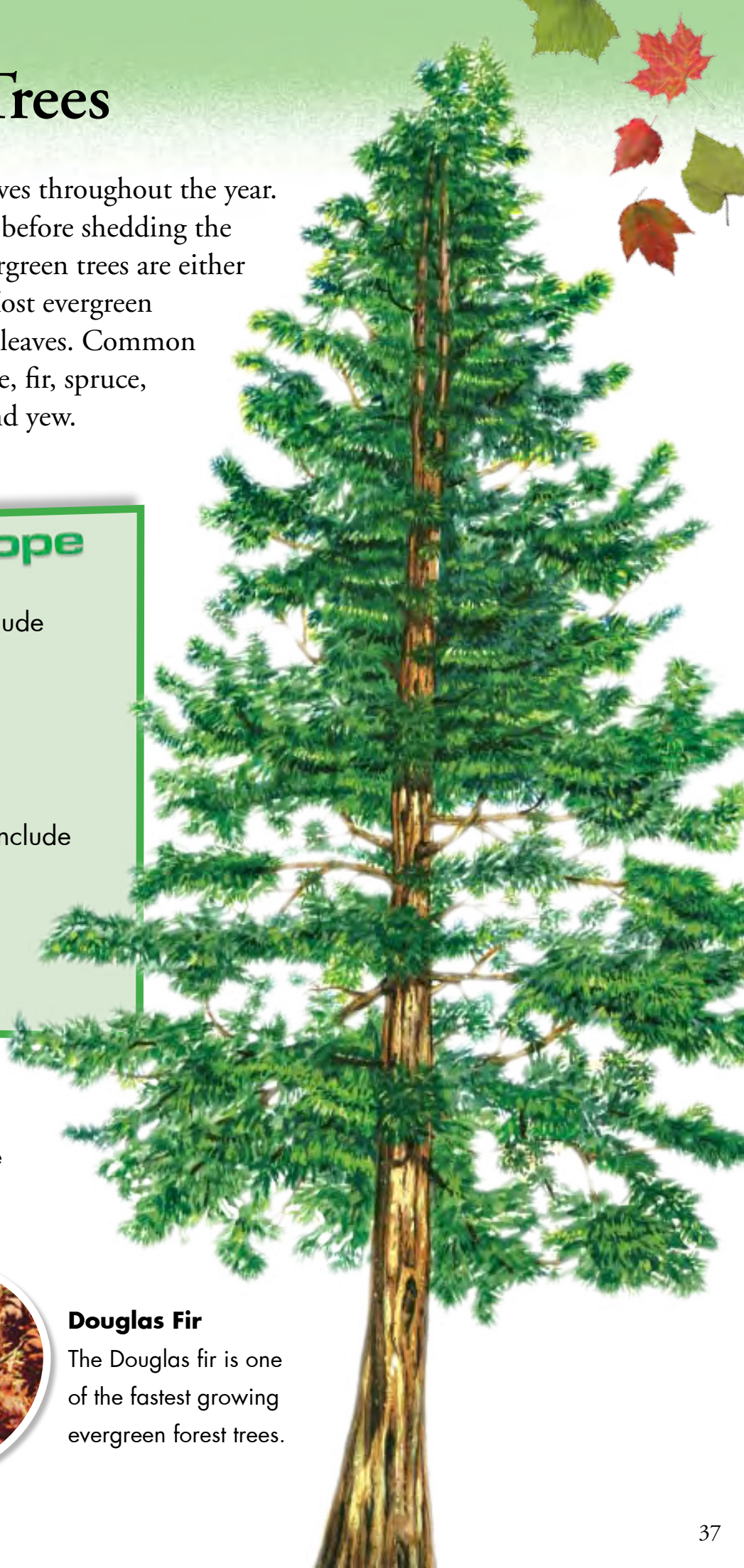
### Emerald Green

The emerald green is a slim tree that is planted in a row to make a hedge.



### Douglas Fir

The Douglas fir is one of the fastest growing evergreen forest trees.





# Deciduous Trees

**D**eciduous trees shed all their leaves for a part of the year. They do this annually at the end of the growing season. Many deciduous trees bear flowers and pollinate when they are leafless. Maples or elms are examples of deciduous trees.

## fact scope

- Most deciduous trees are broad-leaved trees.
- In cool places, deciduous trees shed their leaves in autumn and avoid the requirement of water in winter.
- In tropics, deciduous trees lose their leaves in the dry season.
- Maples, oaks, chestnuts, and beeches are some examples of deciduous trees of cool-climate regions.
- The leaves of deciduous trees turn brown in autumn because chlorophyll breaks down.

### Examples

- Fruit trees
- Catalpa
- Buckeye
- Bald cypress
- Maple
- Larch



### Redbud Forest Pansy

The redbud forest pansy is an ornamental tree that keeps its maroon color all summer long.

### Weeping Willow

The weeping willow is a hardy tree that grows in moist soils.





# Annuals



**A**nnuals are plants that complete their life cycle in one growing season. They typically show rapid growth during the rainy seasons. They quickly flower, produce seeds, and die. The seeds of annuals lie dormant until the next rainy season. Some plants may be summer annuals and winter annuals. Examples of true annuals include lettuce, corn, pea, marigold, cauliflower, and watermelon.

## fact scope

### Annual hedges include

- Sunflower
- Amaranthus
- Prickly Poppy
- Snowcup
- Spider Flower

### Common annual vines include

- Sweet pea
- Morning glory
- Moonflower
- Cypress vine
- Cardinal climber

### Annuals as Perennials

Amaranth, snapdragon, cosmos, cleome, and petunia are annuals that act like perennials.

### Hanging Baskets

Kenilworth ivy, glory flower, and morning glory are annuals that are used for hanging baskets.



# Perennials

Perennials are plants that live from year to year. They produce flowers and seeds more than once in their lifetime. Perennials are of two types, herbaceous perennials and woody perennials. Herbaceous perennials do not form woody tissues. Woody perennials develop a root system from which they grow new stems; therefore, they get larger each year.

## fact scope

- Perennials grow continuously in warmer and more pleasant climates.
- Perennial plants grow and bloom during the warm part of the year in temperate regions.
- Perennial plants are tolerant of wildfire.
- They are more sensitive to extreme cold winters than trees or shrubs found in cold places.
- Zostera is a perennial that occurs in shallow sea water.
- Begonia and banana are evergreen perennials.
- Perennials have large root systems that help them access water and soil nutrients from deep in the soil.



### Examples of Woody Perennials

- Trees
- Shrubs
- Many vines
- Bamboos

### Examples of Herbaceous Perennials

- Aster
- Foxglove
- Iris
- Red hot poker
- Poppy
- Phlox





# Broadleaf Trees

## fact scope

- Broadleaf trees are adapted to different climatic conditions.
- They lose all their leaves in the autumn and have new leaves in spring.
- Some broadleaf trees however, are evergreen.
- Holly is an evergreen broadleaf tree.
- Oak and beech are broadleaf trees found in temperate climates.
- Broadleaf trees have a spreading shape and so large quantities of snow accumulate on them.

Broadleaf trees have broad and flat leaves. The leaves are of different shapes and sizes. They are also called hardwood trees. Some tropical broadleaf trees are deciduous, but most are evergreen. Hickory, maples, oaks, mahogany, and alders are common examples of broadleaf trees.



### Broad-Leafed Deciduous Trees

Broad-leafed deciduous trees grow in wet summers and cold winters of temperate regions.

### Seeds

The seeds of broadleaf trees range from acorns to berries.





# Conifers

Conifers are evergreen plants and usually have small, needle-like leaves. Most conifers have tall, straight trunks and narrow branches. They grow in cold or cool climates. Conifers belong to four families: the pine, yew, cypress, and taxodium. The pine family forms the largest group of conifers. It includes pines, firs, hemlocks, larches, and spruces.



## Cone-bearing

Conifers bear two types of cones, producing either pollen or female egg cells.



## Examples

- Most conifers are evergreens.
- They have scale-like leaves.
- Some conifers are also deciduous.
- The larch is a deciduous conifer.
- The monkey-puzzle tree is an evergreen conifer.
- Monkey-puzzle trees are cultivated as ornamental trees.

## Redwood Tree

The tallest tree, the redwood, is a conifer.





# Palm Trees

Palm trees are monocot flowering plants. They mainly grow in warm climates, especially in the tropics. Most palm trees have no branches and the top of the trunk has feather-shaped leaves. They produce seeds, which are usually spherical in shape like coconuts.



## Raffia Palm

The raffia palm has the world's largest leaves that grow up to 65.6 feet.

## fact scope

- Palm trees grow in places that are warm and have a lot of sunshine.
- They are found in Florida, California, and Mexico.
- Some palm trees grow in the desert near oases.
- Palm trees have leaves at the top of the trunk.
- Their leaves look like very big feathers.
- They have tall, erect, unbranched, regularly cylindrical stems.

## Date Palm

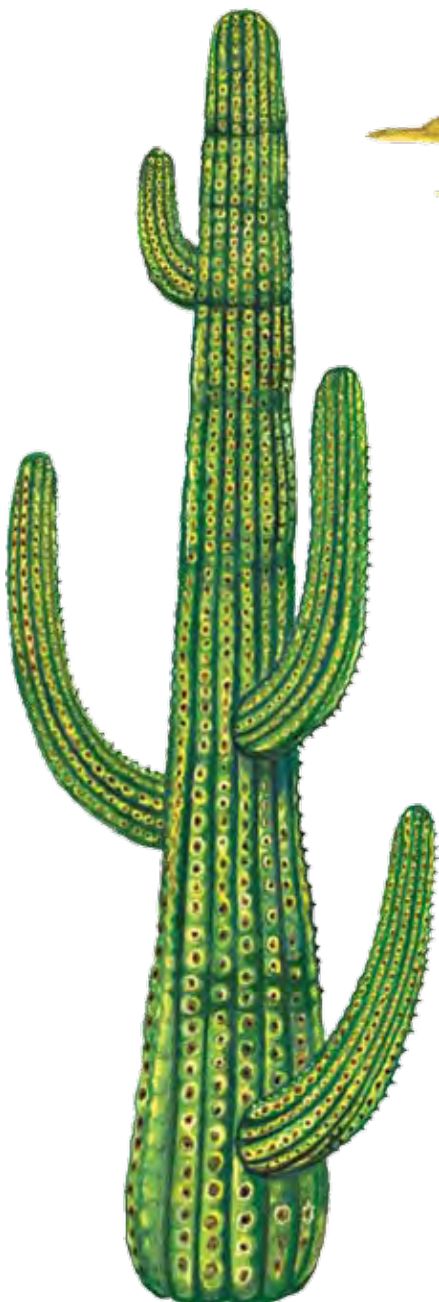
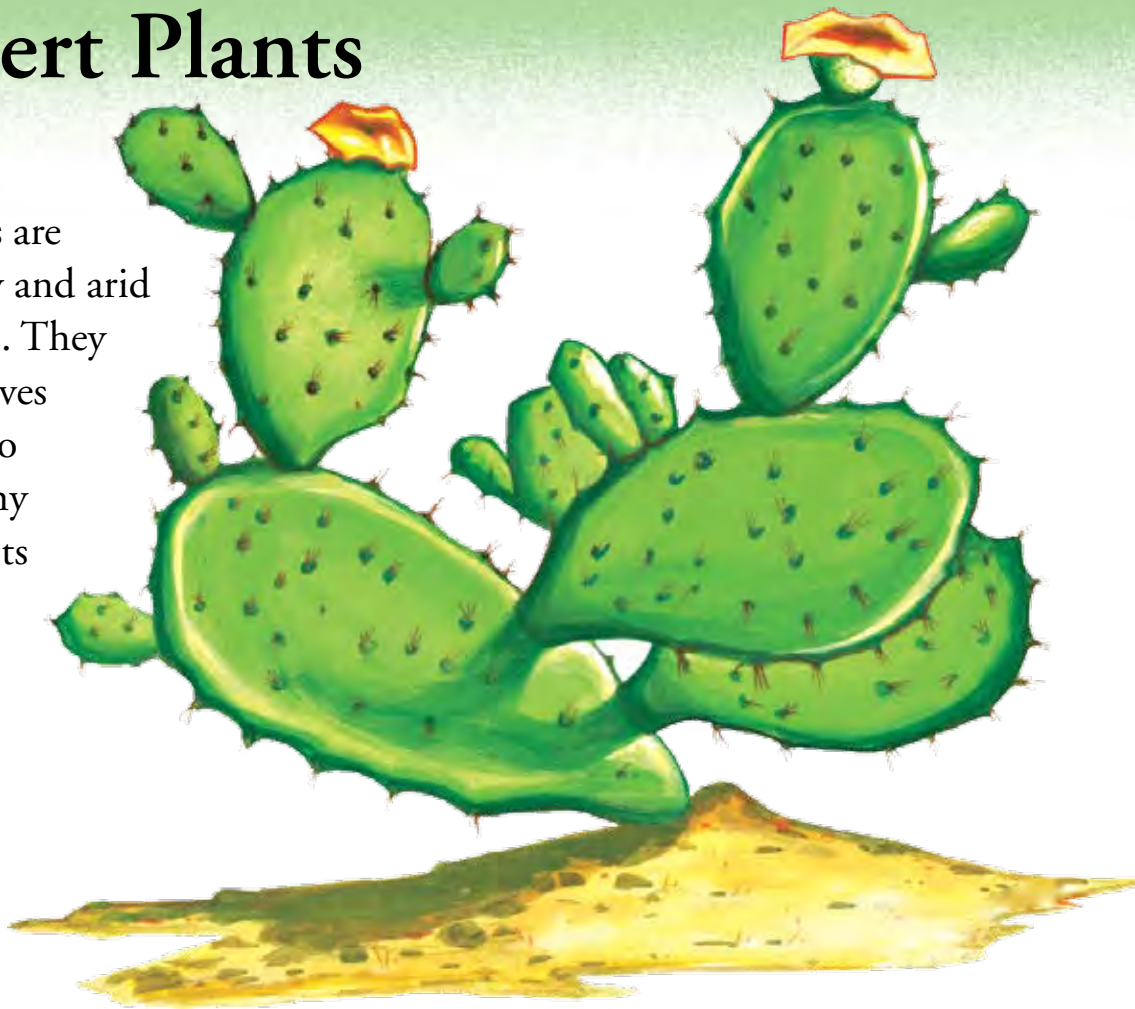
Date palms produce fruit for 60 years.





# Desert Plants

**D**esert plants are found in dry and arid places like hot deserts. They have adapted themselves to live with little or no water. They have fleshy leaves, stems, and roots that absorb surface moisture. Desert plants store water in their spongy tissues.



## Giant Saguaro Cactus

The giant saguaro cactus is the tallest cactus in the world growing up to a height of 65 feet.

## Century Plant

The century plant flowers once in 25 years and then dies.

## fact scope

- Barrel cactus always grows at the top of plants.
- Barrel cactus is packed with a slippery alkaline juice.
- Jumping cholla is also known as "hanging chain cholla."
- Palo verde photosynthesizes through its green bark.
- The ocotillo plant emerges as dead sticks and is most often used as fencing material.
- The Joshua tree can grow both from a seed and from an underground rhizome of another Joshua tree.
- Brittle bush are covered with trichomes (hairs) that act as layers against heat and cold.

# Mountain Plants

Plants that grow on mountains are called mountain plants. Very few plants can grow on mountains tops because of the cold and strong winds. Mosses and lichens are usually the only plants that grow on mountains tops. Flowering plants that grow on mountains are called alpine plants.

## fact scope

- Huckleberry is the state fruit of Idaho.
- Huckleberries are suitable for eating.
- Alpine gentians are small plants positioned upright and 1.18–5.9 inches high.
- Map lichen is so called because it makes thin black map-like margins.
- Mossy saxifrage grows on rocky ground or damp and dry grassland.
- Mountain avens are creeping shrubs that can grow up to 3.14 inches tall.
- Purple saxifrage form small mats or thick cushions with small oval green or gray leaves.



### Leaves

The small and spiky leaves of mountain plants help them to reduce the heat and water loss.

### Blue Gum Eucalyptus

Blue gum eucalyptus is a fast growing evergreen mountain plant used in making medicines.







# Forests

**F**orests are large areas that are densely covered with trees. Forests cover about 30 percent of Earth's total land area. They are home to many species of plants and animals and form a complex ecosystem. Forests are found all over the world and are home to many natural resources.

## Forests and People

About 5 billion people depend on forest resources. More than 1 billion living in extreme poverty around the world depend on forests for their livelihoods.



## Forests at Risk

The increasing demand for wood is depleting forests all over the world.



## fact scope

- 47 percent of total forest area is tropical forest.
- 9 percent of total forest area is subtropical forest.
- 11 percent of total forest area is temperate forest.
- 33 percent of total forest area is boreal forest.
- Forests have effectively disappeared in 25 countries, and another 29 have lost more than 90 percent of their forest cover.
- Only 40 percent of the world's remaining forests are in large, intact areas.
- Forests regulate and purify 57 percent of total water runoff around the globe.
- Forests continuously recycle carbon dioxide into oxygen.
- Cutting down and burning a tree that is 11.8 inches in diameter releases 1.1 tons of carbon into the atmosphere.



# Rainforests

Rainforests are dense forests found in tropical regions. They receive very heavy rainfall, because of which they are called rainforests. Rainforests cover about 7 percent of the planet's surface. They are home to more than half of all plant and animal species on Earth.



## fact scope

- The rainforests are responsible for recycling and cleaning water.
- 7 percent of the total the earth's surface is tropical rainforests.
- The soil of temperate rainforests is richer in nutrients than that of tropical rainforests.
- The trees of tropical rainforests capture the carbon dioxide from the atmosphere and store in leaves, stems, roots, etc.
- Insects are the largest in number of all the creatures in rainforests.
- Most of the animals of temperate rainforests are ground dwellers.
- We get a wide variety of food from rainforests including nuts, fruits, coffee, tapioca, yams, etc.
- Some plants of rainforests are also used in making medicines.

## Temperate Rainforests

Temperate rainforests are fewer than tropical rainforests. They are found along the Pacific coast of the USA and Canada, Chile, New Zealand, etc.



## Tropical Rainforests

Tropical rainforests are found in a belt around the equator. They are spread across Africa, Southeast Asia, Australia, and South and Central America.



# Defenses of Plant

Plants have developed physical and chemical defenses to protect themselves from animals. Physical defenses of plants include such structures as spines, thorns, and prickles. Many plants produce sticky, strong-smelling oils to defend themselves. Some plants also protect themselves through the timing of producing flowers and fruits.



## fact scope

- The seed coats of the castor oil plant contain one of the most toxic substances called ricin.
- Skunk cabbage forms needle-like crystals which, when eaten, can cause an intense irritation and burning sensation.
- The sap of the buttercup plant contains poison, which can cause salivating, irritation, stomach pains, and diarrhea.
- The bark of a Douglas fir protects itself from forest fires.

## Young Fruit

Young fruit of mangoes and some other plants contain antifungal and antimicrobial compounds.



## Plant Defensins

Plant defensins affect the nutrition of pathogens and thus stop their growth.

# Plant Adaptation

Plants have adapted themselves to survive in different habitats. They adapt themselves functionally and reproductively. Functional adaptation helps a plant to adapt to its surroundings, whereas reproductive adaptations help a plant to reproduce successfully.

## fact scope

- Hydrophytes are water-loving plants.
- Xerophytes plants are those that are able to live in very dry places.
- Xerophytes plants are covered with silvery hairs.
- Succulent plants are xerophytes that store energy in stems or leaves.
- Many desert cacti are xerophytes.
- Hydrophytes plants have feathery roots.
- Hydrophytes reproduce vegetatively from fragments.

### Pneumatophores

Pneumatophores are breathing roots that allow gas exchange with the help of pores and lenticels on their surface. They do not get adequate oxygen supply because of waterlogged conditions.

### Halophytes

Halophytes are plants that can grow in salty environments.





# Allelopathy

Certain plants release chemicals, which prevent other plants from growing nearby. This is known as allelopathy. Plants that use allelopathy are black walnut trees, some species of pine trees, sunflowers, wormwoods, sagebrushes, and trees of heaven.



## Tree of Heaven

The tree of heaven releases a chemical, aianthone, from the root barks.

## fact scope

- Plants need air, sunlight, water, and nutrients for growth.
- The plants use allelopathy to protect the resources.
- Harmful growth compounds released from roots of these plants stop the growth of new plants.
- Some chemicals stop the process of photosynthesis of other plants.
- Some plants release chemicals that change the chlorophyll amounts of plants.
- Leaves of some plants fall onto the ground and decompose to release the protective chemicals stored in them.
- Some chemicals are released in the form of gas through leaf openings.

## Black Walnut

The black walnut tree has a chemical, juglone, in the roots, nut hulls, and buds to kill other plants nearby.



# Plants Diseases

Plants are also prone to diseases. Many diseases hinder the normal growth and development of a plant. Virus, bacteria, fungi, nematodes, protozoa, parasitic plants, and other environmental factors cause diseases in plants. Plant pathologists are scientists who study diseases in plants.

## Belly Rot in Watermelon

Belly rot in watermelon results in the decay of the fruit at the area of its contact to soil.



## Early Blight of Potato

Early blight causes dark brown or black target spots on the leaves of the potato plant.



## fact scope

- Black mold of onion is caused by the fungus *aspergillus Niger*.
- Black rot of cabbage is caused by bacteria that can survive in the soil for one year.
- Leaf blotch is a wheat disease that weakens the crop but does not kill the plants.
- Mango sunburn results from heating when water or sprayed material on the fruit surface concentrates sunlight.
- Banded chlorosis in sugarcane occurs as a result of cold.



# Plant Pests

Plant pests are harmful and may cause injury to a plant.

Pests usually stunt growth or carry diseases. Pests are capable of damaging entire crops. Plant pests include insect, mite, nematode, fungus, virus, bacteria, etc. However, the most dangerous of the pests are aphids, spider mites, thrips, and whiteflies.



Some common pests are:

- Aphids
- Scale insects
- Sooty mold
- Spider mites
- White fly
- Mealy bugs are common sucking insects.
- Citrus leaf miner is a common pest that affects all citrus plants.
- Slugs and snails are common garden pests that destroy young seedlings.
- Fungus gnats are small black flies whose larvae are greenhouse pests.
- Thrips are slender, tiny insects that feed by rasping the plant surface and sucking up the exuding sap.
- All caterpillars chew on leaves and other parts of plants.



## Pest Control

Baits, insecticides, pesticides, termiticides, rodenticides, and traps can be used to control pests.

## Locusts

Locusts form dense aggregations as swarms and rapidly devastate crops.



# Carnivorous Plants

Carnivorous plants feed on insects. A carnivorous plant first traps the insect, then kills and digests it. Carnivorous plants usually grow in soil that is thin, acidic, and poor in nutrients like nitrogen. There are over 600 species of carnivorous plants living on Earth. The most famous carnivorous plant is the Venus flytrap.

## Pitcher Plants

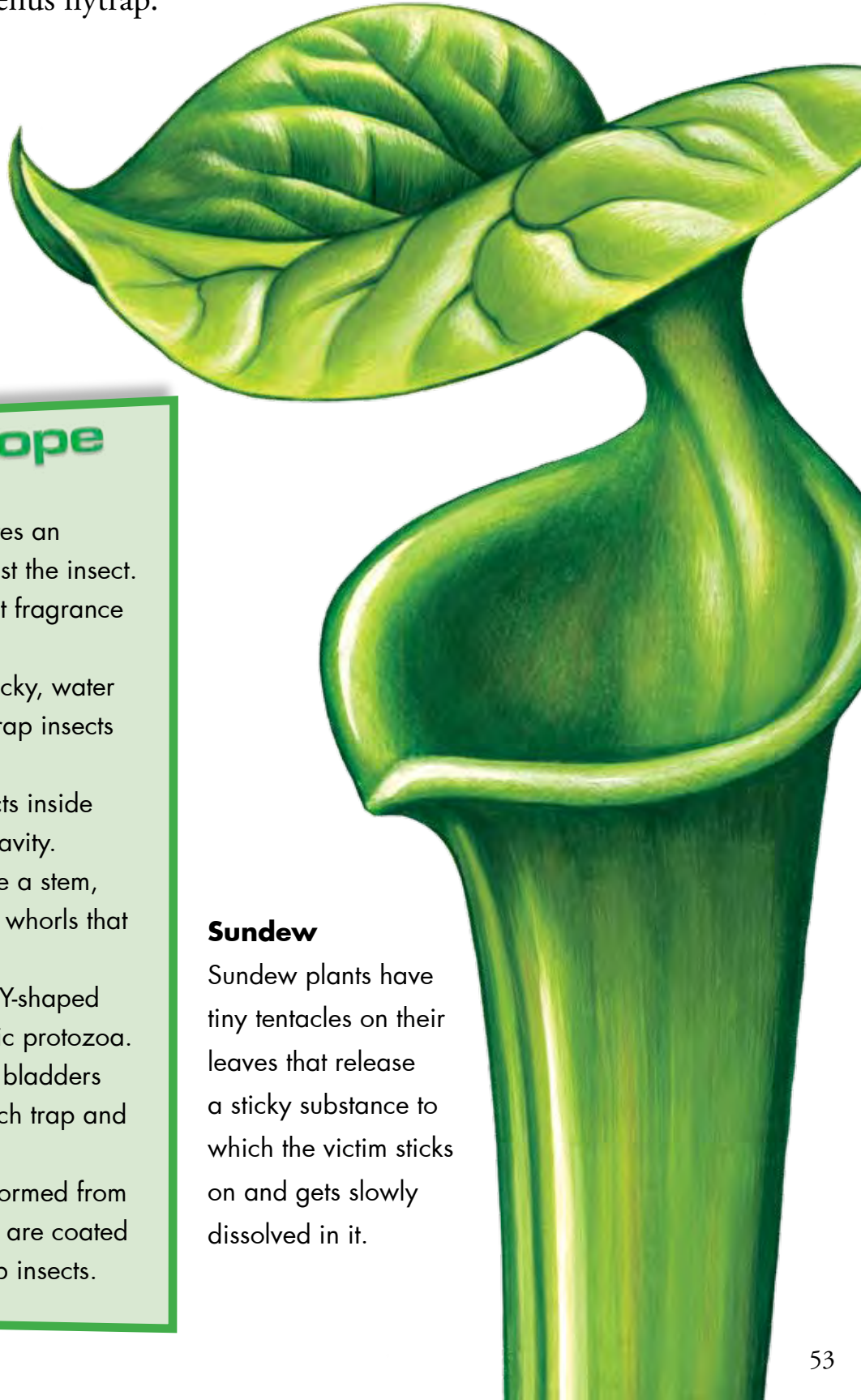
Pitcher plants have pitchers that grow on long tendrils. The plants use these pitchers to catch their food.

### fact scope

- The Venus flytrap secretes an enzyme to kill and digest the insect.
- Sundews exude a sweet fragrance that attracts insects.
- Butterworts secrete a sticky, water drop-like substance to trap insects on their leaves.
- Pitcher plants trap insects inside their deep pitcher-like cavity.
- Waterwheel plants have a stem, which is surrounded by whorls that trap insects.
- Corkscrew plants have Y-shaped leaves that catch aquatic protozoa.
- Bladderworts have tiny bladders attached to leaves, which trap and digest insects.
- Bromeliads have cups formed from overlapping leaves that are coated with waxy scales to trap insects.

## Sundew

Sundew plants have tiny tentacles on their leaves that release a sticky substance to which the victim sticks on and gets slowly dissolved in it.





# Poisonous Plants

Poisonous plants contain a poisonous part that can be harmful to an animal or human being. These plants can cause serious illness, injury, or even death to humans or animals. Poisonous plants are found all over the world. Poison hemlock, poison ivy, hemp, and mistletoe are examples of poisonous plants.

## Toxicity

Poisonous plants can be toxic to eat or touch and cause allergic reactions by mixing with air.



## Remedies

Plants like poppies, quinine, and atropine have poisons that are used as remedies to treat ailments.



## fact scope

- The toxin in buttercup causes gastrointestinal and intense oral irritation.
- Foxgloves carry poison in its leaves, flowers, and seeds.
- Jasmine affects the digestive and nervous system.
- Oleander contains the toxins oleandrin and nerioside and is one of the most poisonous plants.
- Oaks affects the kidneys slowly and symptoms are visible only after several days or weeks.
- Mayapple contains toxins in its roots and some cause diarrhea.

# Aquatic Plants

Aquatic plants are also known as hydrophytic plants or hydrophytes. They have adapted themselves to aquatic habitats and can grow only in water or permanently saturated soils. They have air sacs and large flat leaves that help them to float on water.

## Duckweed

Duckweed has a waxy cuticle on the upper surface that helps it in repelling the water to keep the stomata open.



## Floating Plants

Floating plants have large air spaces in the roots that help them to float on water surface so that they can get adequate sunlight.



### fact scope

- Water lilies are able to reproduce by budding.
- Duckweeds are the smallest flowering plant in the world.
- Hornwort is called so because of their elongated horn-like structure.
- Water lettuce is a very violent attacker and able to form thick floating mats.
- Utricularia is the largest genus of carnivorous plants.



# Medicinal Plants

Plants have been used to make medicines since ancient times. The Chinese were the first to use the medicinal qualities of plants about 5,500 years ago. Medicinal plants are sometimes preferred over pharmaceutical drugs because they do not have as many side effects.



## **Eucalyptus**

Infections, colds, and coughs are treated with eucalyptus. The vapors of eucalyptus ease congestion in the bronchi and clears the sinuses.

## **fact scope**

- Juniper eases stomach aches. It is used in the treatment of inflammation and also helps to check fluid retention.
- Aloe vera reduces the risk of infection and speeds the process of healing.
- Belladonna relieves peptic ulcers and relaxes distended organs.
- Celery cures diseases like arthritis, rheumatism, and gout.
- Lemon is useful in cold and flu. It also relieves stomach infection, arteriosclerosis, and inflammations.
- Mistletoe is used as a cancer treating plant.

## **Olive**

Olive is used to treat gallstones, cystitis, and lower blood pressure. It also improves the functioning of the circulatory system.



# Exotic Plants

Exotic plants are unusual plants. They are strikingly different in shape and color from normal plants. Exotic plants include orchids, cycads, bamboos, palms, bonsai, cacti, tree ferns, aroids, bananas, grasses, and unusual perennials. Many exotic plants are often used as ornamental plants.

## Exotic Beach Plants

Palm trees are exotic beach plants. They are big trees that grow in warm places like coastal regions.

### fact scope

- Aroids are exotic houseplants that grow in warm regions.
- Bamboos are tall and edible grasses.
- Palms bear spherical-shaped fruits.
- Agave plants look like cactus because of their thick, fleshy leaves.
- Morning glory bears funnel-shaped flowers that bloom in the morning and die out by afternoon.
- Bonsai is an ornamental form of growing miniature trees.
- Orchids are the largest family of exotic plants.
- Orchids have the tiniest seeds in the world, making them a challenge to grow and cultivate.
- The seeds of the morning glory were first used in China for medicinal purposes.

## Aroids

The fruits of aroids are bright-colored berries in tight clusters. Corms, rhizomes, and vines are aroids.





# Endangered Plants

Many species of plants are likely to become extinct. These plants are called endangered plants. Plants become extinct because of many reasons like destruction of habitat, decline in pollinating insects, urban development, and agriculture. About six percent of all plant species are endangered.

## Saguaro Cactus

The saguaro cactus is endangered due to slow maturing, slow breeding, and over-collection.

## Wollemi Pine

The Wollemi pine is also known as the dinosaur tree. The plant was considered extinct, but in 1994 two Wollemi pine trees were discovered.



## fact scope

- Muiri tree has been used for treating various disorders.
- The dawn redwood has been called "a living fossil" because it was first discovered in Japan by Miki in 1941, and then found growing in the wild in China.
- African violets are cultivated extensively as houseplants.
- Kakabeak was featured on a New Zealand two cent stamp in 1967.
- Baker's larkspur grows on decomposed sedimentary rock within coastal scrub plant communities.
- Hickman's potentilla is a non-glandular flowering plant of the rose family.

# Wildflowers

**W**ildflowers are flowering plants that grow on their own. There are three types of wildflowers: annual wildflowers, perennial wildflowers, and biennials wildflowers. Annual wildflowers live only for one growing season. Perennial wildflowers live for more than one growing season. They grow larger clumps with more flowers as they age. Biennials are the smallest group of wildflowers. They live for two growing seasons, blooming only during the second.

## Lady Slipper's Orchid

Lady slipper's orchid grows only in one place in Yorkshire, England.

## Examples of Perennial Wildflowers

- Common daisies
- St. John's wort
- Goldenrods



## fact scope

- Rose angel is an annual wildflower and famous for its consistent flowering over the long summer season.
- Evening primrose is used for medicinal purposes. Seed oil is used to relieve itchiness and to ease symptoms of premenstrual syndrome.
- Purple coneflower extracts taken orally from roots and leaves can stimulate the immune system and increase resistance to infections.
- Ox-eye daisy has been successfully used in curing cough, asthma, and nervous excitability.





# Bonsai

Bonsai are artificially dwarfed trees grown in shallow pots.

They are ordinary trees and shrubs that are grown as a miniature version of the original tree. Bonsai is a Japanese word, which means, “planted in a tray.” Elm, maple, pine, flowering apricot and cherry, Japanese wisteria, and juniper are commonly grown as bonsai.



## fact scope

- Although bonsai are small in comparison to their huge life-sized brothers, most are over 9.84 inches tall and up to 3.28 feet in height.
- Bonsai can be developed from seeds or cuttings from young trees or from naturally occurring stunted trees transplanted into containers.
- There are different styles of bonsai: upright, informal, cascade, semi-cascade, raft, literati, and group forest.
- Bonsai wiring is one of the most powerful tools to control the shape of the tree.

### Outdoor Plants

Most bonsai are styled from hardy woody plants, which remain outdoors all seasons of the year.

### Branches of Bonsai

Bonsai has branches decreasing in size from bottom to top. The branches are larger at the bottom and smaller at the top.



# Orchids

Orchids are the largest and the most diverse group of flowering plants. Orchids are monocots, unlike most flowering plants, which are dicots. There are about 25,000 species of orchids. The most distinguishing feature of orchids is the unusual shape and striking colors of its flowers.

## Vanilla

Vanilla species are the only orchids that are grown not only for its beauty but also for their flavor and fragrance.

### fact scope

- Orchids occur on the ground (terrestrials), on rocks (lithophytes), and on trees (epiphytes).
- The first orchid from the western hemisphere to reach Europe was vanilla, sent to Spain in 1515.
- *Grammatophyllum speciosum* is the giant of the orchid world and can reach 24.93 feet in height with leaves up to 2.49 feet long.
- Orchid plants cannot be cured if infected with a virus.
- There can be up to 3 million seeds in a single orchid seedpod.



## Bee Orchid

The bee orchid has a yellow and brown colored lip that looks like a female bee. It attracts the male bee.





# Greenhouse

**G**reenhouses are buildings where plants are grown all year round. They provide a controlled environment for raising plants indoors. The roof is slanted to admit maximum sunlight. Humidity is controlled by the amount of water used in the soil. Vegetables, flowers, shrubs, and other types of plants are grown in greenhouses.



## Largest Greenhouse

The largest greenhouse complex is in Leamington, Ontario. Tomatoes are grown in a greenhouse of 200 acres.

## John Todd

John Todd invented a special greenhouse that purified sewage utilizing bacteria, plants, and animals.



## fact scope

### Uses of greenhouse

- Providing food supplies to places where food is not available
- Protecting plants from too much heat, cold, storms, etc.
- Keeping away pests

### Maintenance of greenhouse plants

- Greenhouses should be kept clean and tidy throughout the year.
- Necessary procedures of plants like pricking, summer pruning, and fruit thinning should be done on time.
- Regular watering is required.
- Treatment of pests and diseases should be done on time.

# Plant Products

Plant products can be broadly grouped into two types—edible and non-edible. Edible plant products may be natural or processed. Vegetables, fruits, and spices are natural products. Processed plant products include cereal products, flour, rice, oils, syrups, juices, and jams. Non-edible products include cotton, linen, paper, and rubber. Many plants are also used for making dyes and medicines.

## fact scope

- Plants are the main source of medicine.
- Garlic, visnaga, and thorn apple are antiasthmatic plants.
- Sweet fern and walnut are blood purifier plants.
- Spiny amaranth and Chinese yam act against poisons.
- Mint, asparagus, and cypress are fever-treating plants.
- Goatweed, onion, bearberry, artichoke, etc. are stone removing plants.
- Beech is an acidity relieving plant.

### Other uses

- Fibers extracted from plants are used for making cloth, rope, paper, etc.
- Dyes are obtained from plants to color fabrics.
- Oil-rich seeds are used to extract oils.
- Fuel for lighting and lubricants in paints and varnishes are also obtained.



### Cotton

Cotton is a flexible fiber used in clothing, furnishing and other household fabrics, medical dressings (such as cotton balls, lint, and band-aids), tarpaulins, tent canvas, and in passports and banknotes.

### Coconut Palm

The coconut palm is a multipurpose plant that provides edible nuts, oil, coir, timber, thatch, charcoals, etc.





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# PLANTS

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